Electronic Supplementary Material (ESI) for ChemComm.


# Catalytic Asymmetric Sulfenylation to Structurally Diverse Dithioketals

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## Supporting Information

## Contents

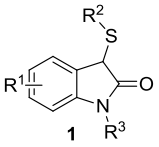
**General**: Reactions were monitored by thin layer chromatography using UV light to visualize the course of reaction. Purification of reaction products was carried out by flash chromatography on silica gel. Chemical yields refer to pure isolated substances. NMR spectra were obtained using a Bruker DPX-400 spectrometer. Chemical shifts are reported in ppm from tetramethylsilane with the solvent resonance as the internal standard. The following abbreviations were used to designate chemical shift multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, h = heptet, m = multiplet, br = broad.

All reactions were run in air except noted. Anhydrous THF and toluene were prepared by distillation over sodium-benzophenone ketyl prior to use. Anhydrous $CH_2Cl_2$ and $CH_3CN$ were prepared by first distillation over $P_2O_5$ and then from $CaH_2$. Anhydrous EtOAc and acetone was prepared by first distillation over activated $CaSO_4$ and then stored in 5 Å molecular sieves. The powdered 13X molecular sieves was purchased from Alfa Aesar and activated by heating at 150 $^oC$ under vacumm for 8 hours before using. The *S*-based nucleophiles **1**[1] and **5**[2] were prepared according to literature reports. Sulfenylation reagent **2**[3] and **7**[4] were synthesized according to literature methods.

**List of abbreviation:**

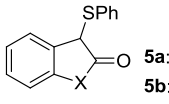
| Entry | Chemical name | Abbreviation | Entry | Chemical name | Abbreviation |
|---|---|---|---|---|---|
| 1 | Petroleum ether | PE | 3 | Dimethylsulfoxide | DMSO |
| 2 | Tetrahydrofuran | THF | 4 | Molecular sieve | MS |

**List of starting material:**

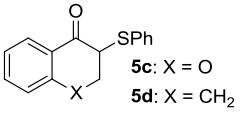


**1**

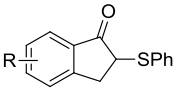
**1a**: $R^1$ = H, $R^2$ = *p*-$ClC_6H_4$, $R^3$ = H
**1b**: $R^1$ = 5-OMe, $R^2$ = *p*-$ClC_6H_4$, $R^3$ = H
**1c**: $R^1$ = 6-OMe, $R^2$ = *p*-$ClC_6H_4$, $R^3$ = H
**1d**: $R^1$ = 7-Cl, $R^2$ = *p*-$ClC_6H_4$, $R^3$ = H
**1e**: $R^1$ = 5,7-$Me_2$, $R^2$ = *p*-$ClC_6H_4$, $R^3$ = H
**1f**: $R^1$ = H, $R^2$ = *p*-$MeC_6H_4$, $R^3$ = H
**1g**: $R^1$ = H, $R^2$ = *o*-$FC_6H_4$, $R^3$ = H
**1h**: $R^1$ = H, $R^2$ = 2-Naphthyl, $R^3$ = H
**1i**: $R^1$ = H, $R^2$ = Bn, $R^3$ = H
**1j**: $R^1$ = H, $R^2$ = Allyl, $R^3$ = H
**1k**: $R^1$ = H, $R^2$ = *p*-$ClC_6H_4$, $R^3$ = Me
**1l**: $R^1$ = H, $R^2$ = *p*-$ClC_6H_4$, $R^3$ = Bn
**1m**: $R^1$ = 5-F, $R^2$ = *p*-$ClC_6H_4$, $R^3$ = Bn
**1n**: $R^1$ = 5-Me, $R^2$ = *p*-$ClC_6H_4$, $R^3$ = Bn



**5a**: X = O
**5b**: X = $CH_2$

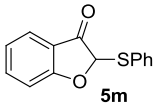


**5c**: X = O
**5d**: X = $CH_2$

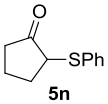


**5e**: R = H
**5f**: R = 4-Br
**5g**: R = 5-Cl
**5h**: R = 5-Br

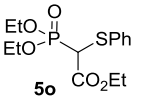
**5i**: R = 6-Br
**5j**: R = 6-Me
**5k**: R = 5-OMe
**5l**: R = 5,6-$(OMe)_2$



**5m**



**5n**



**5o**

[1] (a) F. Zhou, X.-P. Zeng, C. Wang, X.-L. Zhao and J. Zhou, *Chem. Commun.*, 2013, **49**, 2022; (b) W.-M. Gao, J.-S. Yu, Y.-L. Zhao, Y.-L. Liu, F. Zhou, H.-H. Wu and J. Zhou, *Chem. Commun.*, 2014, **50**, 15179.

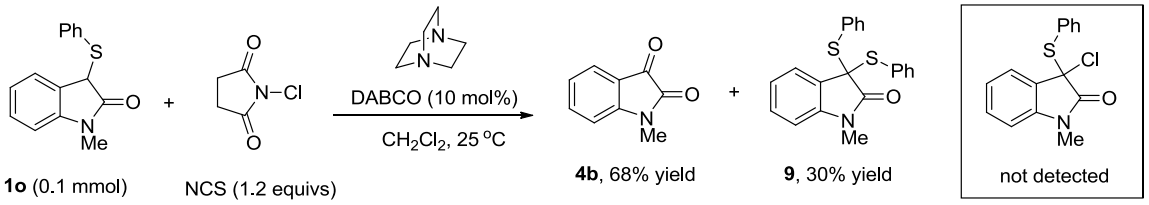
[2] (a) T. Bootwicha, X. Liu, R. Pluta, I. Atodiresei and M. Rueping, *Angew. Chem., Int. Ed.*, 2013, **52**, 12856; (b) X. Wang, T. Yang, X. Cheng and Q. Shen, *Angew. Chem., Int. Ed.*, 2013, **52**, 12860.

[3] P. Saravanan and P. Anbarasan, *Org. Lett.*, 2014, **16**, 848.

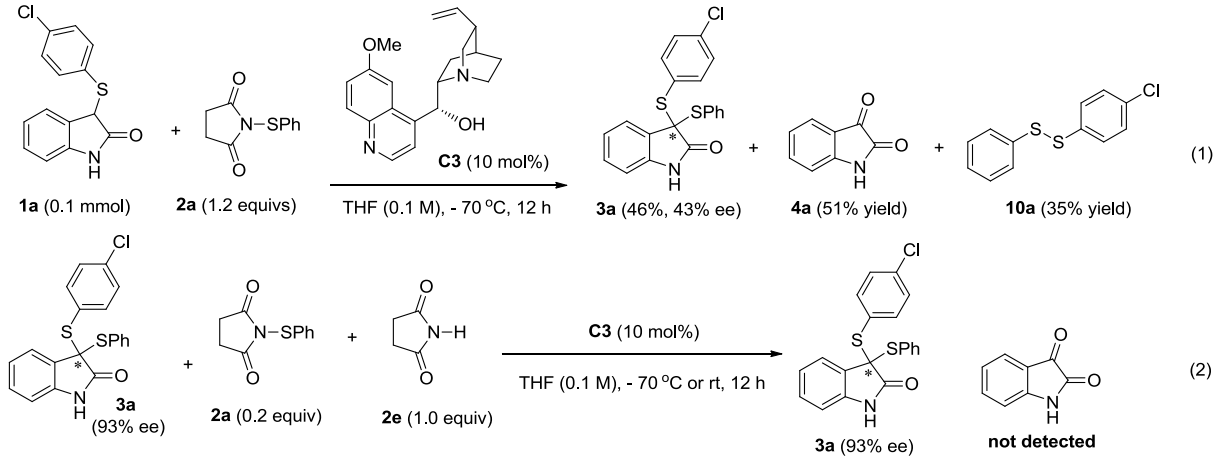
[4] (a) G. Teverovskiy, D. S. Surry and S. L. Buchwald, *Angew. Chem., Int. Ed.*, 2011, **50**, 7312; (b) C. Xu and Q. Shen, *Org. Lett.*, 2014, **16**, 2046.

## 1) Mechanistic consideration

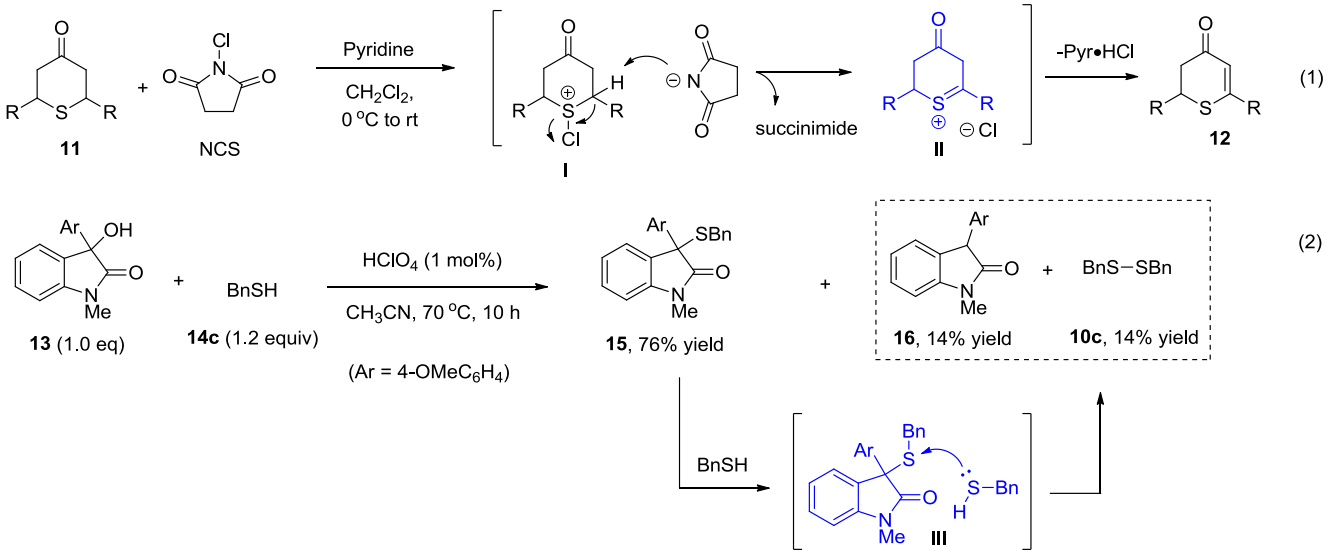
During our studies in base catalyzed reactions of 3-thiooxindoles with some electrophiles, we had noticed the formation of isatin as side products, the amount of which depended on the electrophiles used. For example, the reaction of 3-thiooxindole **1o** with *N*-chlorosuccinimide (NCS) catalyzed by DABCO at 25 $^{o}$C did not afford the desired 3-chloro-3-thiooxindole, but gave symmetric dithioketal **9** and isatin **4b**. The same phenomena were also observed in the reaction of **1o** with other *N*-halosuccinimides.




In the DABCO catalyzed sulfenylation of 3-thiooxindole **1a** using *N*-SPh succinimide **2a** at room temperature, isatin formation was not observed. However, in the corresponding asymmetric studies, isatin formation proved to be troublesome when we tried lowering temperature to -70 $^{o}$C to improve enantioselectivity. For example, when using quinine **C3** as the catalyst, dithioketal **3a** was obtained in only 46% yield, but isatin was isolated in 51% yield, along with unsymmetrical disulfane **10a** in 35% yield (eq 1). Dithioketal **3a** proved to be stable under reaction condition or during the purification by column chromatography. Even **3a** was stirred with quinine **C3**, **2a** and **2e** at -70 $^{o}$C or room temperature for 12 h, no isatin was detected, and it was recovered in unchanged ee value (eq 2). Moreover, without **2a**, no isatin formed if stirring 3-thiooxindole **1a** with catalyst **C3** at the same condition for 12 h (eq 3).



To account for these observations, an investigation into literature report promoted us to consider that 3-thiooxindoles might attack electrophiles in an *S*-nucleophilic way to form a sulfonium salt that further underwent side reactions, owing to their ambident nucleophilicity. For example, in the synthesis of dihydro-4H-thiopyran-4-one **12** from tetrahydro-4H-thiopyran-4-one **11** via oxidative elimination reaction, in the presence of pyridine, Chen et al proposed that the *S*-nucleophilic attack of **11** to NCS led to the formation of chloro-sulfonium salt **I**, which was then deprotonated to form a thionium ion **II**, with the dissociation of a chloride (eq 1 of Scheme S1).[5] It should be noted that thionium ion intermediate was also proposed in the Pummerer reaction.[6]



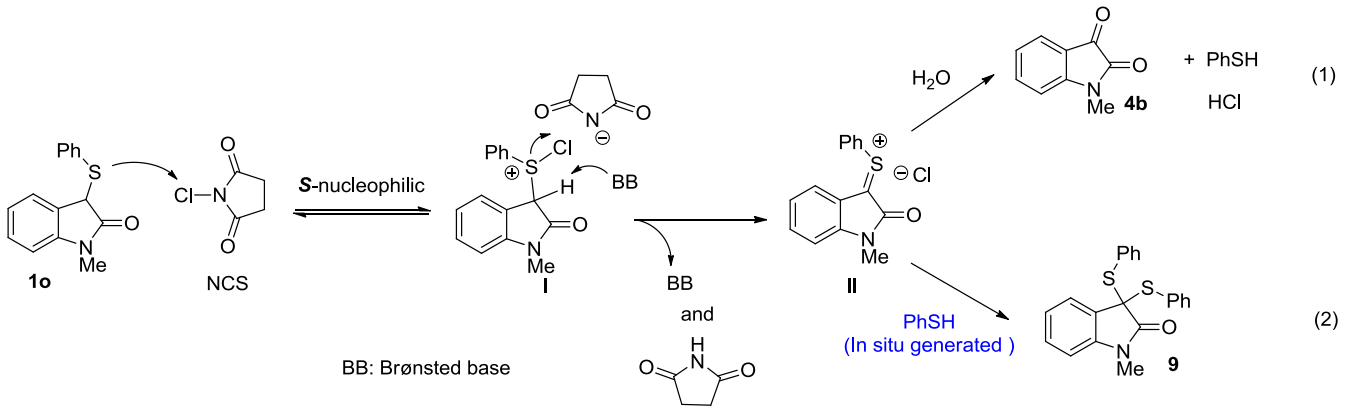

**Scheme S1.** Useful literature information

On the other hand, the attack of a sulfur atom on electrophilic sulfur species is possible.[7] For example, the nucleophilic attack of a mercaptan on sulfenimides had also been reported.[8] In addition, we had previously observed that in the acid-catalyzed substitution of BnSH with 3-substituted hydroxyoxindoles **13**, 3-monsubstituted oxindole **16** and a disulfane **10c** were formed as side products, possibly through the attack of a mercaptan to the sulfur of 3-alkylthiooxindole **15** (eq 2 of Scheme S1).[9] Such a phenomenon was also reported by Magnus.[10]

Accordingly, it was possible that in the reaction of 3-thiooxindole and NCS, the *S*-nucleophilic

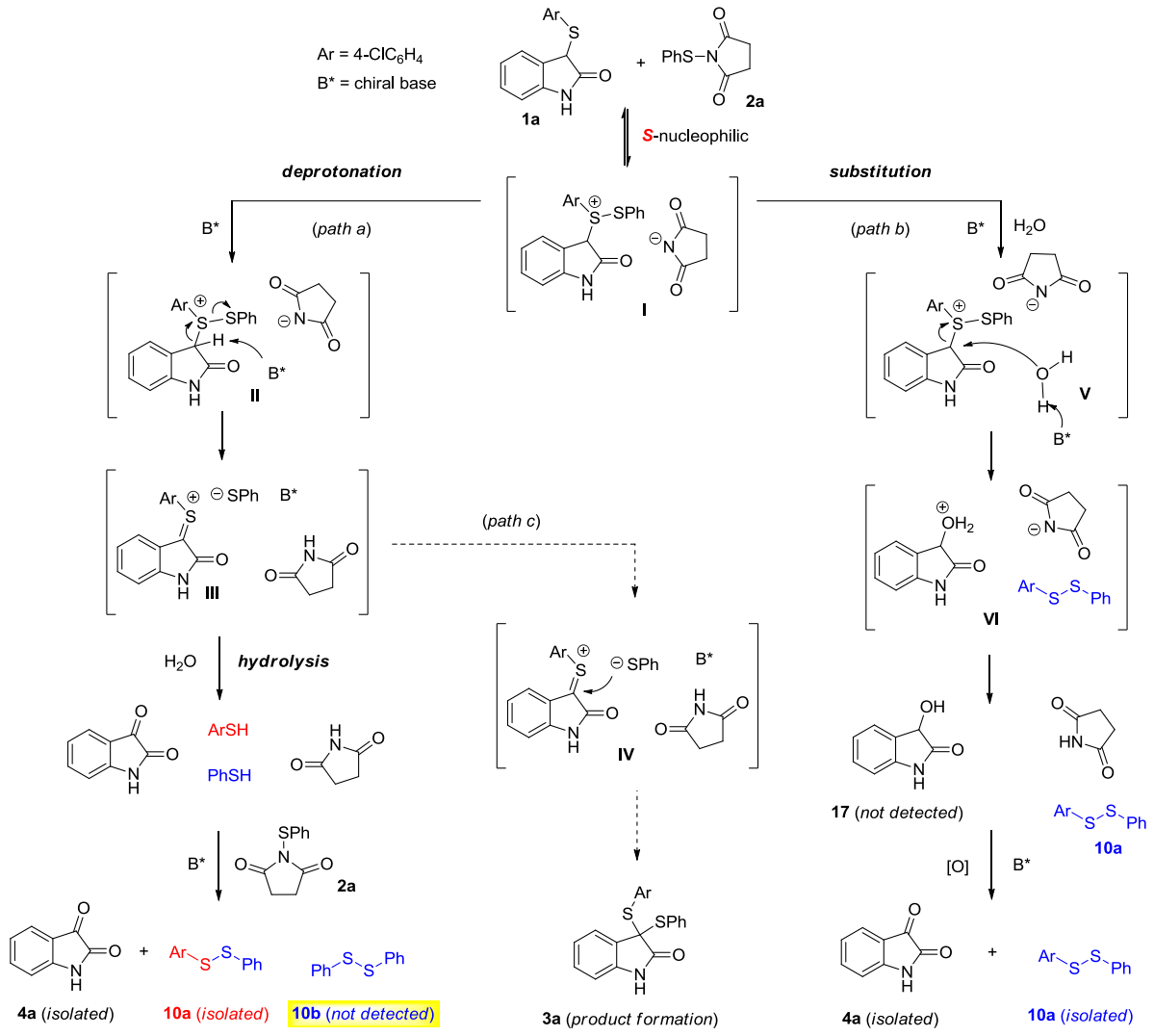
[5] C. H. Chen, G. A. Reynolds and J. A. V. Allan, *J. Org. Chem.*, 1977, **42**, 2777.
[6] L. H. S. Smith, S. C. Coote, H. F. Sneddon and D. J. Procter, *Angew. Chem., Int. Ed.*, 2010, **49**, 5832 and references therein.
[7] P. Chauhan, S. Mahajan and D. Enders, *Chem. Rev.*, 2014, **114**, 8807 and reference therein.
[8] K. S. Boustany and A. B. Sullivan, *Tetrahedron Lett.*, 1970, **11**, 3547.
[9] F. Zhu, F. Zhou, Z.-Y. Cao, C. Wang, Y.-X. Zhang, C.-H. Wang and J. Zhou, *Synthesis*, 2012, **44**, 3129.
[10] P. Magnus, M. Ladlow and J. Elliott, *J. Am. Chem. Soc.*, 1987, **109**, 7929.

attack of 3-thiooxindole **1o** to NCS would form a sulfonium salt **I**, which then produced a thionium ion intermediate **II** upon deprotonative activation by the base. The following hydrolysis readily afforded isatin **4b** and thiophenol. The in situ generated thiophenol may undergo a nucleophilic addition to sulfur stabilized carbonium ion **II** to give dithioketal **9**, owing to its high nucleophilicity (Scheme S2).




**Scheme S2.** Possible mechanism for the reaction of 3-thiooxindole **1o** and NCS

While this mechanism reasonably explained the formation of symmetric dithioketal **9** and isatin **4b** in the reaction of 3-thiooxindole **1o** and NCS catalyzed by 10 mol% DABCO, it was insufficient to explain isatin formation in the sulfenylation of 3-thiooxindole. For a detailed discussion, see Scheme S3. If the initial *S*-nucleophilic attack of **1a** to **2a** afforded sulfonium salt **I** that was deprotonated to give thionium ion **III** (path a). The hydrolysis of thionium ion **III** should produce both *p*-chlorophenyl and phenyl mercaptan. Therefore, both unsymmetrical and symmetric disulfane **10a-b** might be produced via the reaction of the two different thiophenols with *N*-SPh succinimide **2a**, as shown by the control experiments (eq 1 of Scheme S4). Judged by this analysis, both disulfanes **10a-b** should be detected. However, although we isolated isatin in 51% yield and unsymmetrical disulfane **10a** in 35% yield by column chromatography, we failed to isolate symmetric disulfane **10b**. We further tried GC-MS analysis of the reaction mixture to detect whether symmetric disulfane **10b** was formed or not. Unfortunately, since dithioketal **3a** easily decomposed under the EI-analysis condition, and the characteristic peak of unsymmetric disulfane **10a**, symmetric disulfane **10b**, along disulfane **10d** derived from *p*-chlorophenyl mercaptan were all detected, no matter using pure sample of dithioketal **3a** or the reaction mixture for GC-MS analysis (see Figure S2-S3). The LC-MS analysis was also tried, but failed to afford useful information, due to the low molecular weight of disulfane compounds.

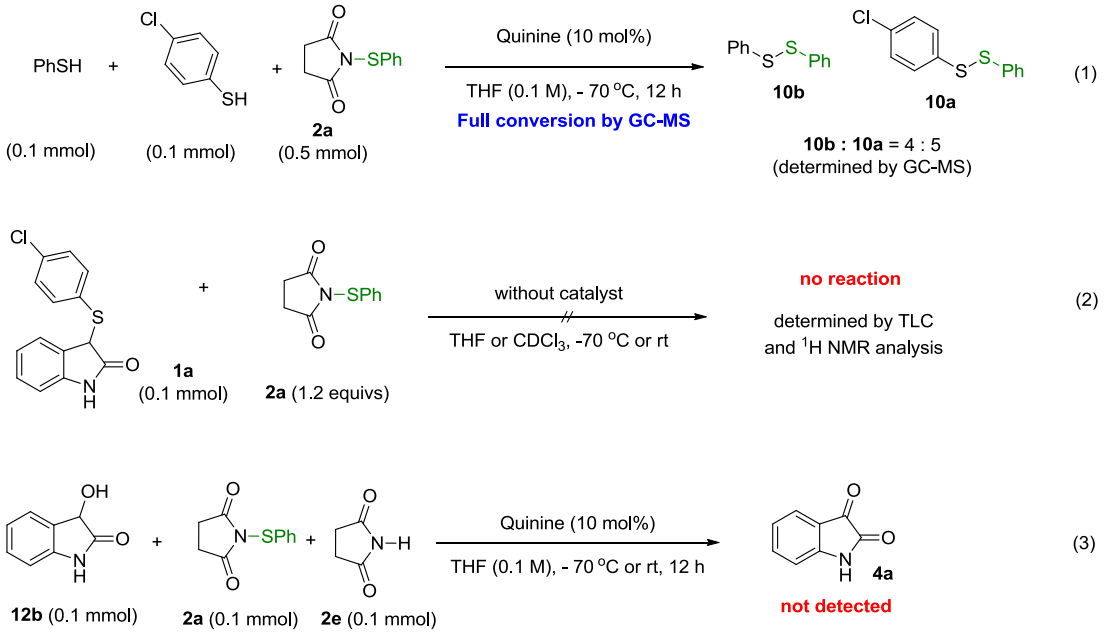



**Scheme S3.** Possible mechanism for isatin formation in the sulfenylation of 3-thiooxindole **1a**.

To account for why only unsymmetrical disulfane **10a** was produced, along with isatin, in the sulfenylation of 3-thiooxindole **1a**, we considered an alternative substitution reaction pathway (path b, Scheme S3). This possible reaction pathway was based on literature report that dioxindole could be oxidized under basic condition,[11] and no reaction occurred if just mixing 3-thiooxindole **1a** and *N*-SPh succinimide **2a** without the addition of base catalyst (eq 2 of Scheme S4). Once the *S*-nucleophilic attack of **1a** to **2a** produced the sulfonium salt **I**, a further base-assisted nucleophilic attack by water generated **10a** and dioxindole **17**. Then dioxindole was further oxidized to isatin. However, although this route could reasonably explain why only unsymmetrical disulfane **10a** was isolated, it was not in accordance

[11] (a) G. Bergonzini and P. Melchiorre, *Angew. Chem., Int. Ed.*, 2012, **51**, 971; (b) Q. Gui, F. Dai, J. Liu, P. Chen, Z. Yang, X. Chen and Z. Tan, *Org. Biomol. Chem.*, 2014, **12**, 3349; (c) G. A. Russell, C. L. Myers, P. Bruni, F. A. Neugebauer and R. Blankespoor, *J. Am. Chem. Soc.*, 1970, **92**, 2762; (d) O. J. Sonderegger, T. Bürgi, L. K. Limbach and A. Baiker, *Journal of Molecular Catalysis A*, 2004, **217**, 93.

with our control experiment that no isatin was detected if stirring a mixture of dioxindole **17**, *N*-SPh succinimide **2a**, succinamide **2e** and 10 mol% quinine in THF at -70 °C or room temperature for 12 hours (eq 3 of Scheme S4). Whether the in situ generated dioxindole might be more reactive to be oxidized under our reaction condition was not clear at current stage.




**Scheme S4.** Control experiments

Currently, although two possible reaction pathways had been proposed to account for the side isatin formation reaction in the sulfenylation of 3-thiooxindole **1a**, both of them were not in perfect agreement with the experimental data. The detailed mechanism waited for further investigation. Nevertheless, data provided above suggested that side reaction might result from the undesired *S*-nucleophilic attack of 3-thiooxindole **1a** to *N*-SPh succinimide **2a**.

The above analysis also raised an issue whether the thionium ion intermediate **III** might directly convert the desired chiral dithioketal **3a**, in the presence of the chiral catalyst (path c, Scheme S3). To get more information, we monitored the reaction by NMR analysis, as shown in Figure S1.

The NMR analysis of the reaction course provided some useful information. First, without the addition of extra base, no change was monitored even after **1a** and *N*-SPh succinimide **2a** was mixed for 12 h (*a*, *b*, *e* and *f* of Figure S1), which was in accordance with the control experiment that no reaction took place without a base catalyst (eq 2, Scheme S4). Second, the proton at C3 position of 3-thiooxindole **1a** could be easily deprotonated by **C4**, as the characteristic peak of C3 proton of **1a** at δ

4.55 ppm immediately broadened after the addition of 5 mol% catalyst **C4** for 5 min (*a* vs *g*). Third, the reaction proceeded very fast at room temperature, as the characteristic peak of C3 proton of **1a** became very weak after the addition of 5 mol% catalyst **C4** to the mixture of **1a** and *N*-SPh succinimide **2a** for 5 minutes, and then completely disappeared after 20 minutes (*h* and *i* of Figure S1). We also tried lowering the catalyst loading to 1.0 mol% to detect the possible interemediates, but we still failed to detect the chracteristic C3 proton of dioxindole (*d* vs *j-l* of Figure S1).

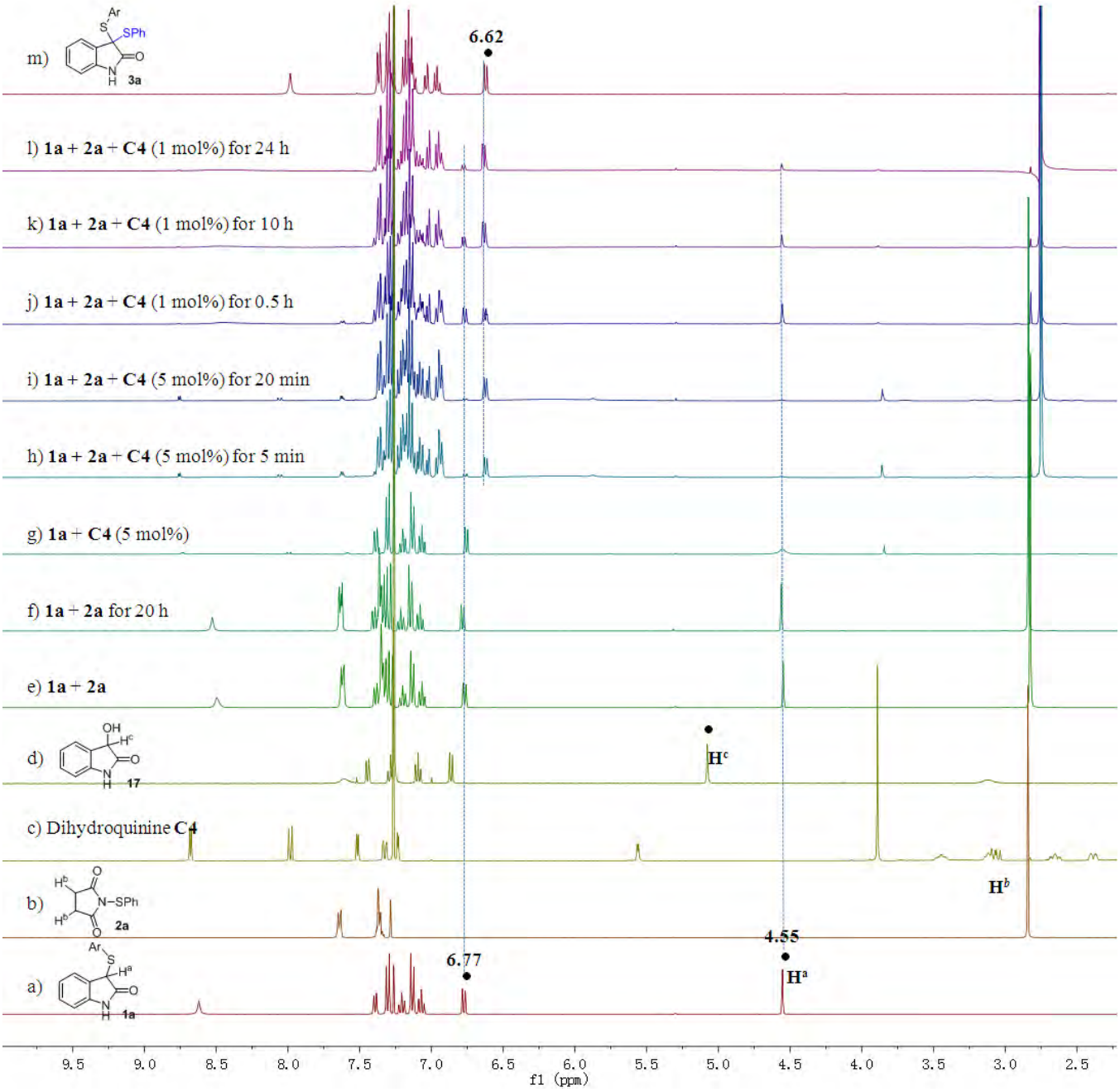
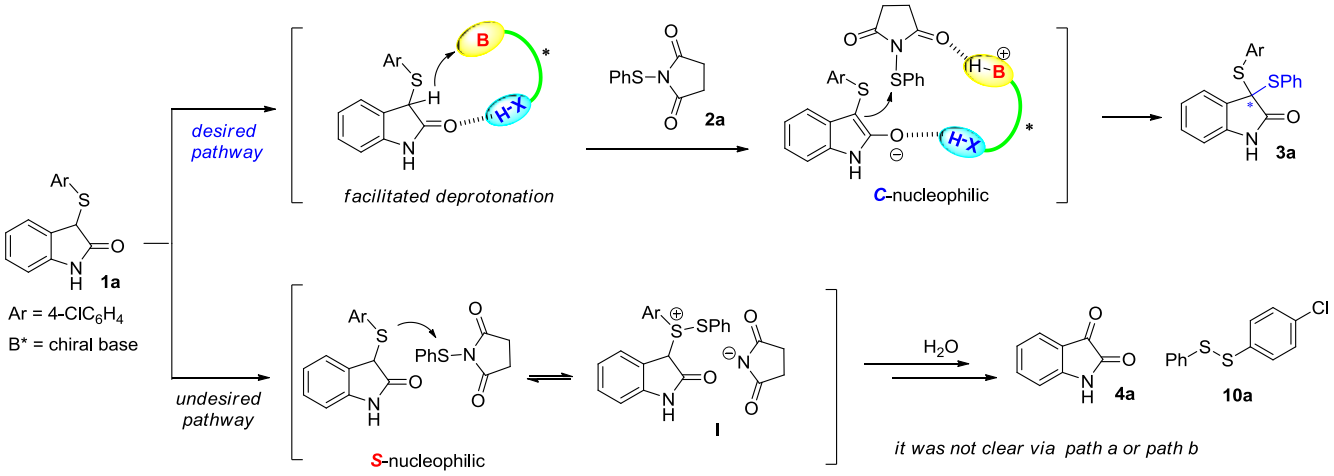



**Figure S1.** NMR analysis of the reaction course.

Owing to the facile deprotonative activation of C3 proton of 3-thiooxindole **1a**, we tended to believe that the desired chiral dithioketal **3a** was generated via the *C*-nucleophilic reaction pathway (Scheme S5), rather than via the pathway c shown in Scheme S3, but the detailed mechanism studies waited for further investigation. In addition, the excellent enantioselectivity of dithioketal **3a** implied that chiral catalyst could achieve effective enantiofacial control in the transition state, but it seemed difficult for catalyst **C4** to realize good control over conversion of thionium ion intermediate **III** that included a sulfur stabilized carbonium ion and a benzenethiolate (Scheme S3).

Based on the aforementioned analyses, although the details waited for further studies, we believed that in the base-catalyzed sulfenylation of 3-thiooxindole, the *C*- and *S*-nucleophilic pathways were two competitive reaction paths. When reaction was carried out at room temperature, the deprotonative activation of 3-thiooxindole was very easy, so *C*-nucleophilic pathway dominated to afford the desired dithioketal **3a**, without isatin formation detected. On the other hand, when the catalytic asymmetric reaction was run in low temperature to improve the enantioselectivity, the *S*-nucleophilic pathway could not be ignored, as the deprotonative activation of 3-thiooxindoles was slowed down greatly. By data accumulated to date, we believed that the formation of a sulfonium salt **I** in the *S*-nucleophilic pathway was responsible for the formation of isatin side product, but further detailed mechanistic studies were required. Based on this analysis, it was reasonably explained why the use of bifunctional tertiary amine catalysis was effective in suppressing the isatin formation at low reaction temperature, as the H-bonding interactions between 3-thiooxindoles and H-bond donors might facilitate the deprotonative activation, for the desired *C*-nucleophilic reaction pathway (Scheme S5).




**Scheme S5.** Bifunctional catalysis in the sulfenylation reaction.

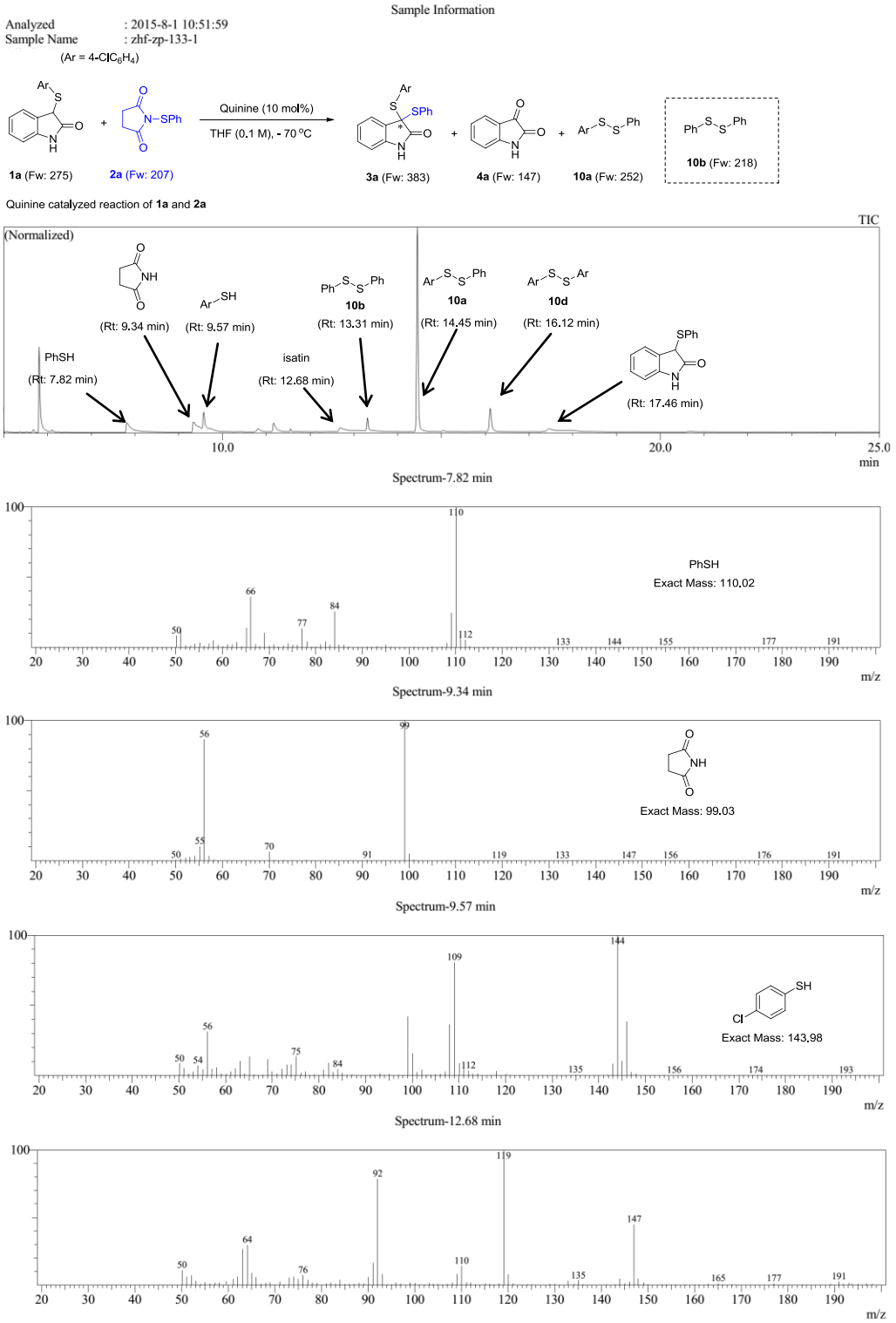



**Figure S2-1.** GC-MS analysis of the reaction mixture of **1a** and **2a**.

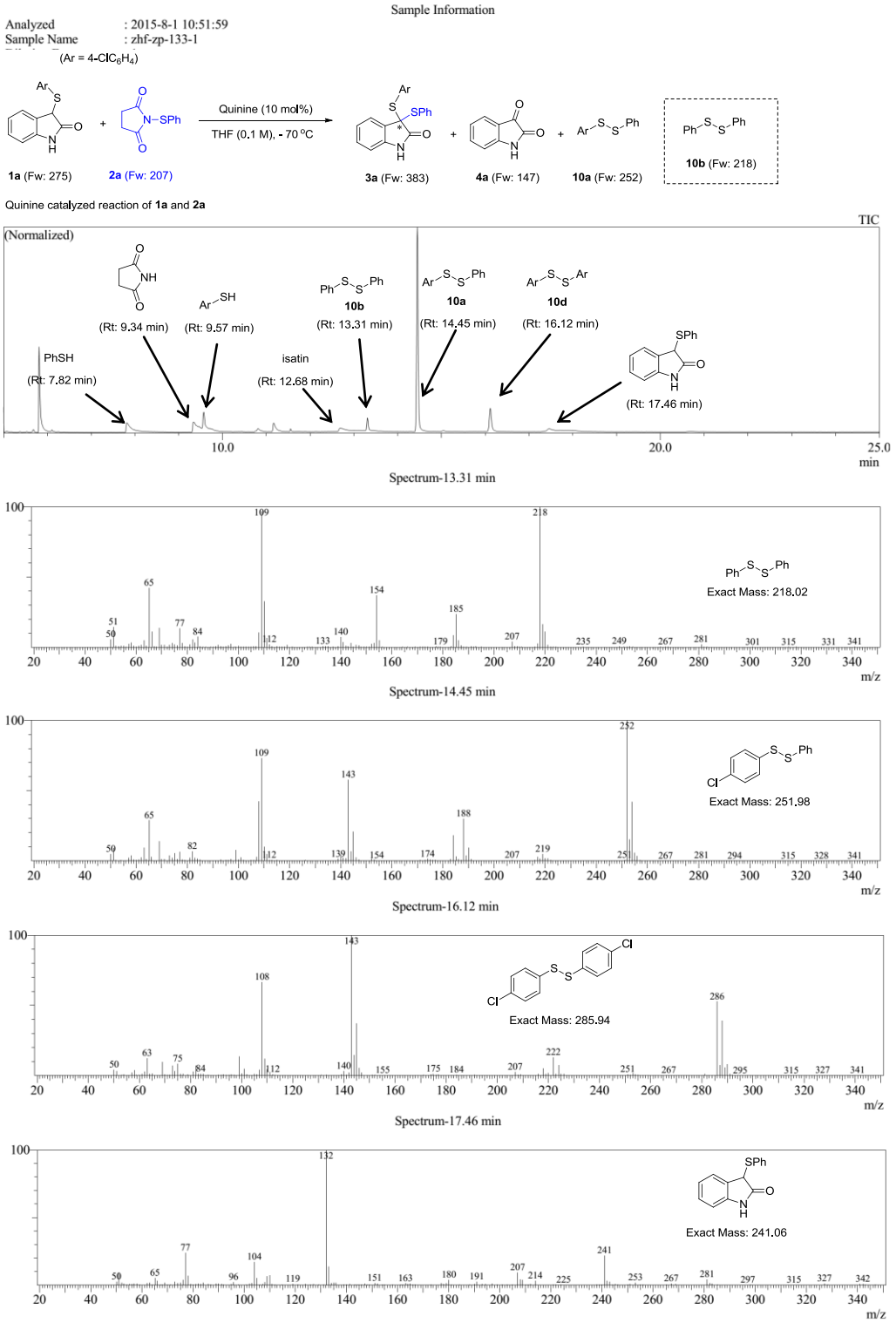



**Figure S2-2.** GC-MS analysis of the reaction mixture of **1a** and **2a**.

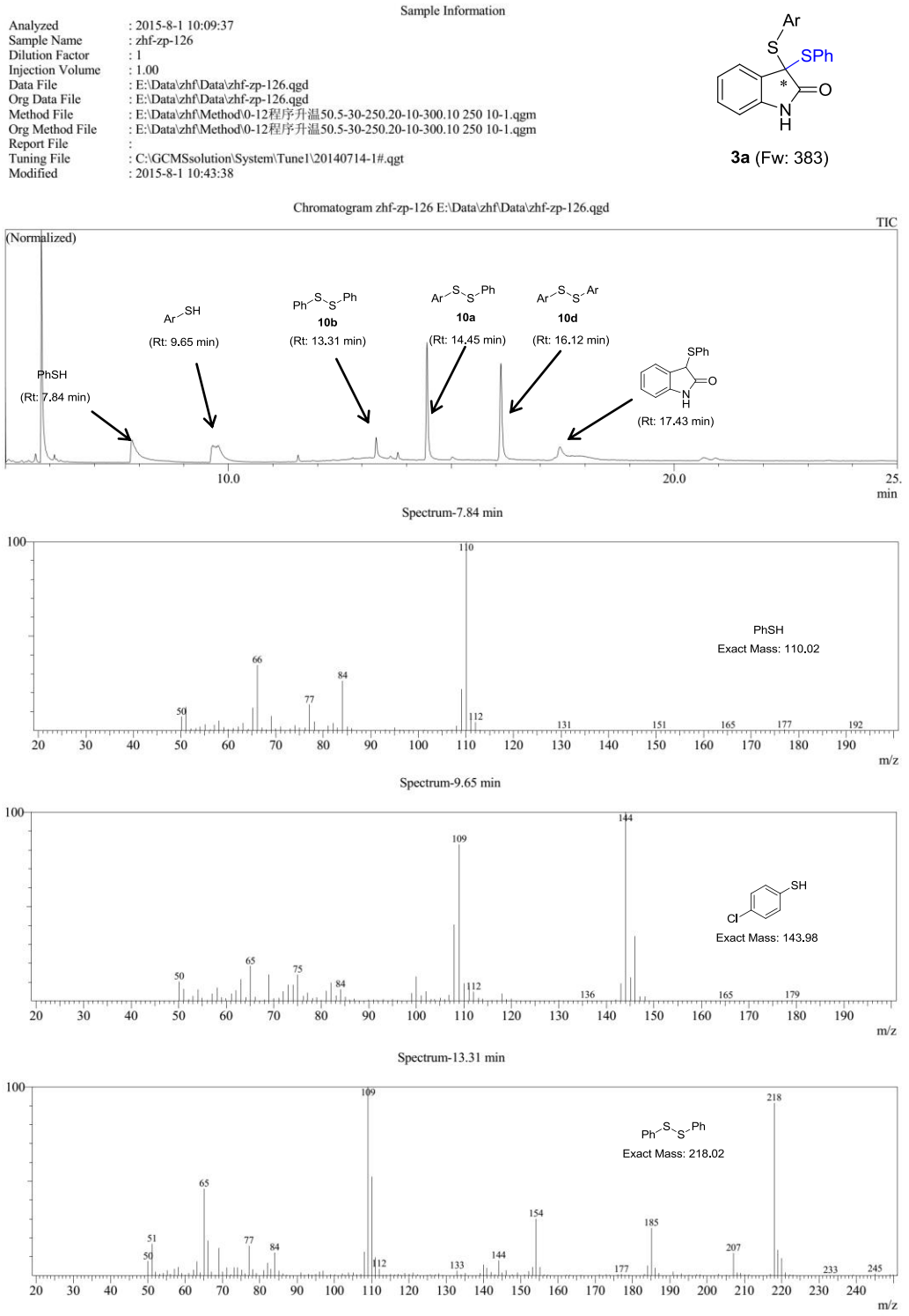



**Figure S3-1.** GC-MS analysis of the dithioketal **3a**.

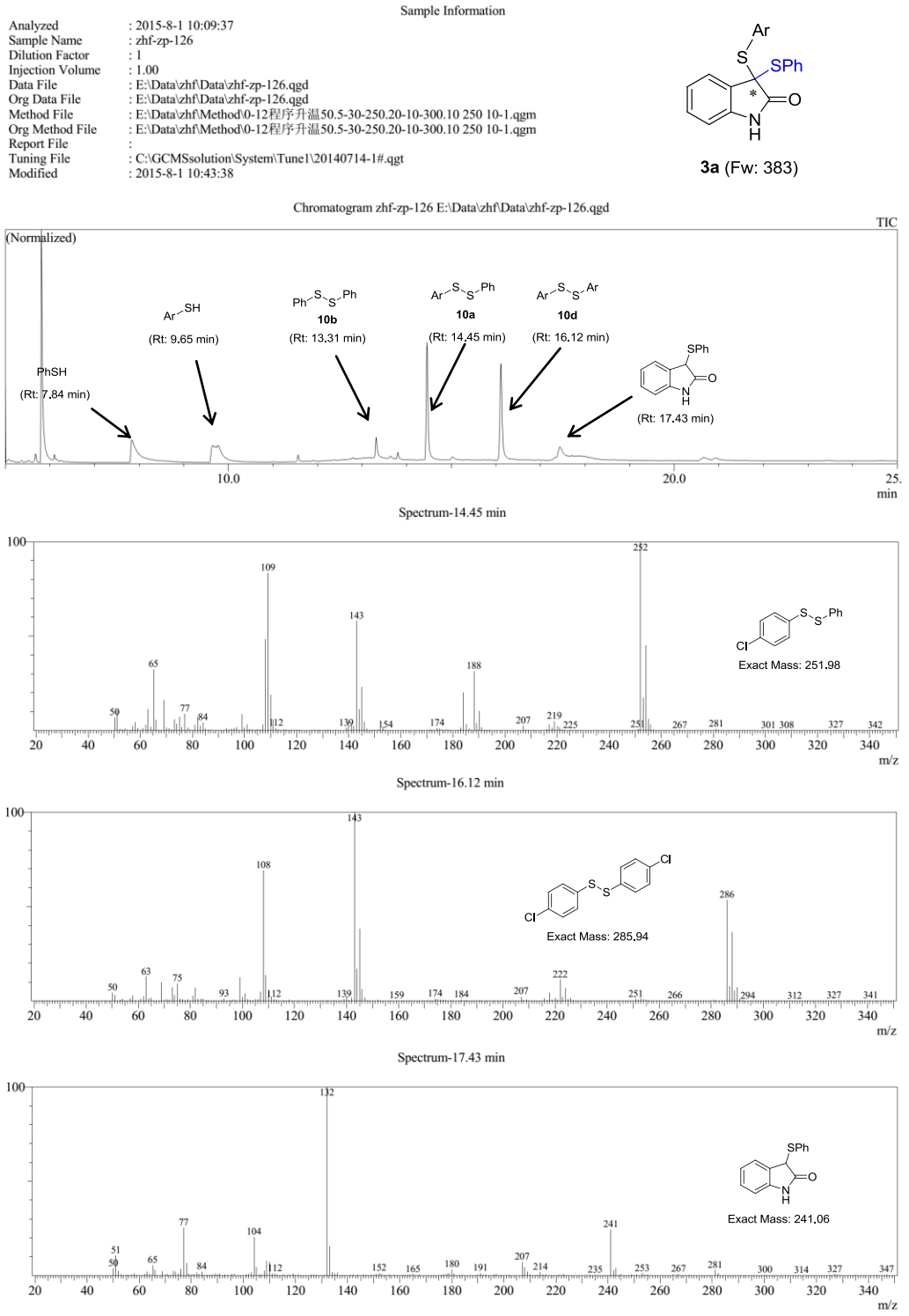
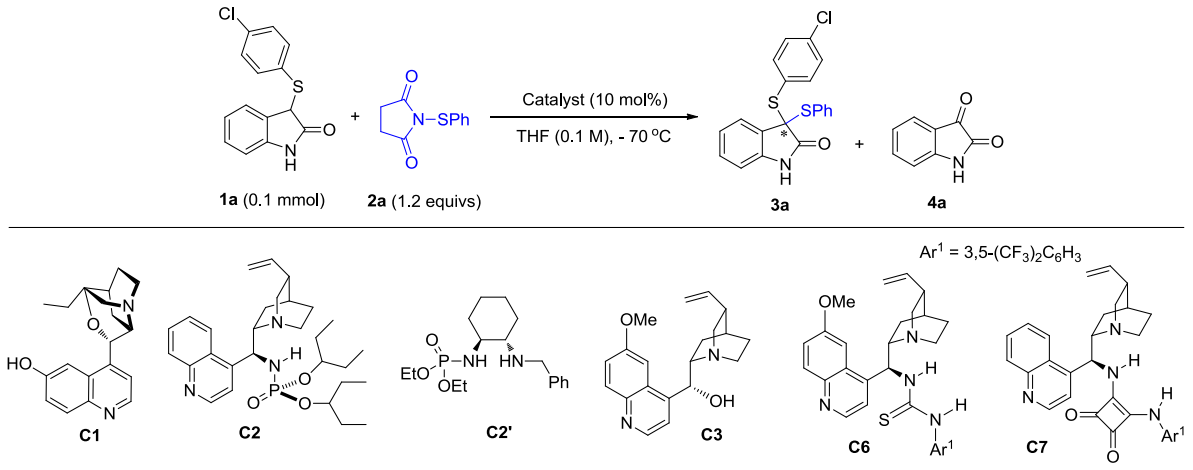



**Figure S3-2.** GC-MS analysis of the dithioketal **3a**.

**2) Condition optimization.**

Initially, the reaction of 3-thiooxindole **1a** and *N*-phenylthiosuccinimide **2a** in THF was selected to determine the performance of orgaocatalysts, typical results were shown in Table S1. With bifunctional catalyst **C1** or **C2**, which we employed for amination[1a] and Michael addition[1b] reaction of 3-thiooxindole, respectively, all afforded side product isatin **4a** in significant amount, along with desired product **3a** in low yield and ee value (Table S1, entry 1-2). The isatin formation was also severe when the reaction promoted by secondary amine-phosphoramide **C2'**, which we developed recently[12] (entry 3). Simple and commercial available quinine **C3** catalyzed the reaction in a much faster rate to give **3a** in 43% ee, together with isatin in 51% yield (entry 4). Then catalysts with a dual H-bond donor were also examined. It was found that isatin formation was almost suppressed when using thiourea **C6** as the catalyst, but **3a** was obtained in only 40% ee (entry 5). The squaramide **C7** as catalyst could afford **3a** in up to 79% ee, albeit with isatin in 43% yield (entry 6). By comparison, **C7** gave a better result in terms of yield and enantioselectivity, but **C3** could promote the reaction much faster than others.

**Table S1. Catalyst evaluation.**



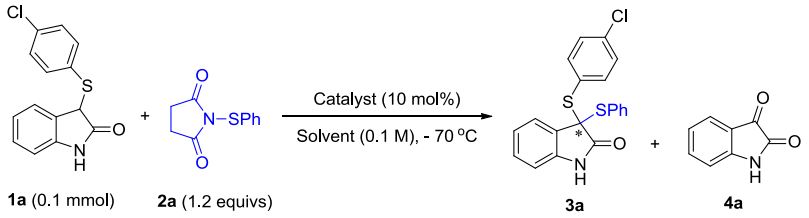

| Entry | Cat. | Time(h) | Yield of **3a**[a] (%) | Ee of **3a**[b] (%) | Yield of **4a**[a] (%) |
|---|---|---|---|---|---|
| 1 | **C1** | 84 | 68 | 3 | 23 |
| 2 | **C2** | 84 | 20 | 15 | 71 |
| 3 | **C2'** | 84 | 65 | 14 | 30 |
| 4 | **C3** | 12 | 46 | 43 | 51 |
| 5 | **C6** | 84 | 82 | 40 | trace |
| 6 | **C7** | 84 | 54 | 79 | 43 |

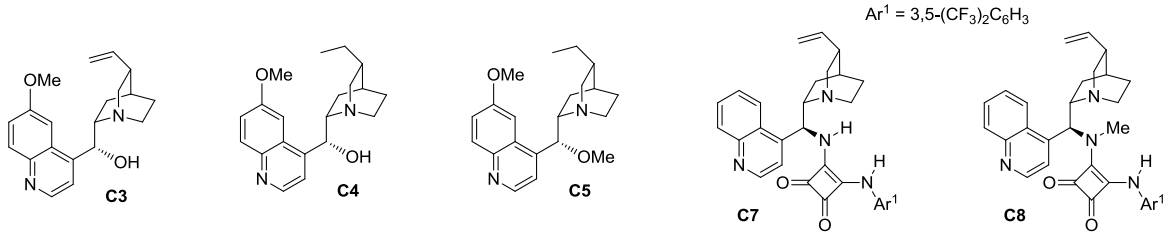
[a] Isolated yield. [b] Determined by HPLC analysis.

[12] J.-S. Yu, F.-M. Liao, W.-M. Gao, K. Liao, R.-L. Zuo and J. Zhou, *Angew. Chem., Int. Ed.*, 2015, **54**, 7381

Afterward, the effect of solvent for the sulfenylation reaction of 3-thiooxindoles **1a** was examined with squaramide **C7** and quinine **C3** as catalyst respectively, and typical results were shown in Table S2.

**Table S2. The solvent effect and control experiments.**




| Entry | Cat. | Solvent | Time(h) | Yield of **3a**[a] (%) | Ee of **3a**[b] (%) | Yield of **4a**[a] (%) |
|---|---|---|---|---|---|---|
| 1 | **C7** | Acetone | 84 | 53 | 66 | 22 |
| 2 | **C7** | Toluene | 84 | 58 | 2 | trace |
| 3[c] | **C7** | $CH_3CN$ | 84 | 65 | 2 | trace |
| 4 | **C7** | $CH_2Cl_2$ | 84 | 72 | 16 | 21 |
| 5[d] | **C7** | THF | 84 | 75 | 79 | 19 |
| 6 | **C3** | Acetone | 12 | 49 | 68 | 41 |
| 7 | **C3** | Toluene | 12 | 65 | 67 | 25 |
| 8[c] | **C3** | $CH_3CN$ | 12 | 81 | 49 | trace |
| 9 | **C3** | $CH_2Cl_2$ | 12 | 82 | 79 | 8 |
| 10 | **C4** | $CH_2Cl_2$ | 12 | 88 | 81 | 7 |
| 11[e] | **C4** | $CH_2Cl_2$ | 24 | 82 | 91 | 7 |
| **12**[f] | **C4** | **$CH_2Cl_2$** | **36** | **78** | **93** | **trace** |
| 13[e] | **C5** | $CH_2Cl_2$ | 24 | 70 | 7 | 20 |
| 14 | **C8** | THF | 84 | 83 | 29 | trace |
| 15 | **DABCO** | THF | 24 | 40 | --- | 56 |

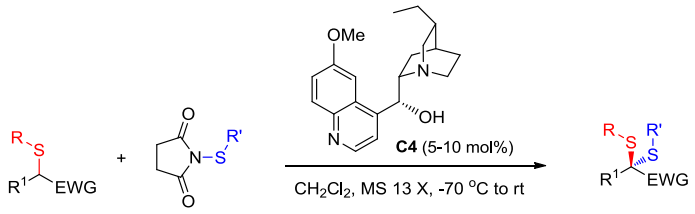
[a] Isolated yield. [b] Determined by HPLC analysis. [c] Run in -40 °C. [d] With 60 mg MS 13X. [e] 0.05 M with 60 mg MS 13X. [f] 0.05 M with 60 mg MS 13X, 5 mol% of **C4**

With **C7** as catalyst, the reaction using acetone as solvent afforded **3a** in 53% yield with 66% ee (Table S2, entry 1). With toluene and $CH_3CN$ as solvent, the ee decreased dramatically to 2%, despite only trace amount of isatin was detected (entries 2-3). In $CH_2Cl_2$, the reaction provided **3a** in 16% ee, together with isatin in 21% yield (entry 4). By comparing, squaramide **C8** gave the best result in THF. We further tried using MS 13X as additive, the isatin formation was suppressed in part, but there was no change in the enantioselectivity (entry 5).

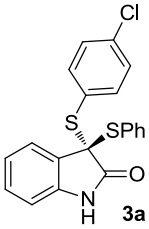
Subsequently, the performance of **C3** in different solvents was examined (Table S2, entries 6-9), and finally $CH_2Cl_2$ was identified as the best one, which afforded the chiral dithioketal **3a** in 82% yield and 79% ee, with the yield of isatin decreasing to 8% (entries 9). Further exploration revealed that dihydroquinine **C4** could give a better result (entry 10). When the reaction concentration decreased from 0.1 M to 0.05 M, with the addition of MS 13X, the enantioselectivity could be improved to 91% (entry 11). Ultimately, using 5 mol% of dihydroquinine **C4**, along with the addition of MS 13X, allowed **3a** to be obtained in 78% yield and 93% ee, accompanied by trace amount of isatin (entry 12).

In order to declare the importance of bifunctional catalysis in this reaction, control experiments were performed (Table S2, entries 13-15). When the hydroxyl group of dihydroquinine **C4** was changed to methoxyl, the methylated dihydroquinine **C5** not only resulted in poor enantioselectivity, but led to the obvious increase in isatin generation (entry 13 vs 11). With one N-H bond of squamide **C7** was masked by a methyl group, the corresponding catalyst **C8**, could inhibit isatin formation, but the ee value of **3a** dropped from 79% to 29% (Table S2, entry 14 vs Table S1, entry 6). When racemic catalyst DABCO (1,4-diazabicyclo[2.2.2]octane) was used under -70 $^{o}$C, the achiral dithioketal **3a** could only be obtained in 40% yield, along with large amount of isatin formed (entry 15). The above results revealed that a suitable H-bond donor might be important for the reaction, which could not only restrain the undesired *S*-nucleophilic pathway, but also contribute to achieving high enantioselectivity.

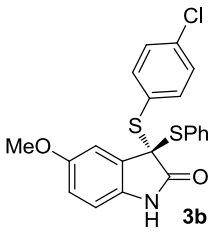
**3) General procedure for the catalytic asymmetric sulfenylation reaction.**




To a 10.0 mL vial were added dihydroquinine **C4** (0.0125 or 0.025 mmol) and *S*-based nucleophiles (0.25 mmol), followed by 5.0 mL of $CH_2Cl_2$ and 150 mg MS 13X. The resulting mixture was stirred at indicated temperature for about 30 min before the corresponding electrophilic sulfenylation reagents (0.30 mmol) was added. After the full conversion of *S*-based nucleophiles by TLC analysis, the solvent was carefully removed under reduced pressure. The residue was directly subjected to flash column chromatography to afford the desired chiral dithioketals, using the indicated eluent.

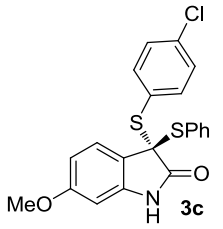

**3a**

Column chromatography (PE/EtOAc = 6:1 to 3:1) afforded the desired product **3a** in 78% yield as pale pink solid (m. p. 134-136 $^{o}$C). HPLC analysis (Chiralpak AD-H, $^{i}$PrOH/hexane = 10/90, 1.0 mL/min, 230 nm; $t_r$ (minor) = 16.537 min, $t_r$ (major) = 15.396 min) gave the isomeric composition of the product: 93% ee, $[\alpha]^{28}_{D}$ = -17.0 (c = 0.91, $CHCl_3$); $^{1}$H NMR (400 MHz, $CDCl_3$): δ 7.98 (s, 1H), 7.38-7.36 (m, 2H), 7.32-7.28 (m, 3H), 7.20-7.11 (m, 5H), 7.04-7.03 (m, 1H), 6.96 (t, *J* = 7.6 Hz, 1H), 6.62 (d, *J* = 7.6 Hz, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 175.72, 139.60, 137.71, 136.50, 136.27, 129.81, 129.57, 129.19, 128.77, 128.58, 127.97, 127.91, 125.51, 122.52, 110.34, 63.06; IR (KBr): 3240, 1735, 1701, 1616, 1470, 1093, 746, 685; HRMS (ESI): Exact mass calcd for $C_{20}H_{14}NOS_2{}^{35}Cl^{23}Na$ $[M+Na]^+$: 406.0103, Found: 406.0108.

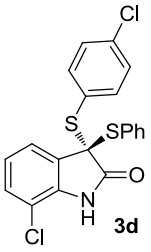

**3b**

Column chromatography (PE/EtOAc = 6:1 to 3:1) afforded the desired product **3b** in 73% yield as pale pink solid (m. p. 146-148 $^{o}$C). HPLC analysis (Chiralpak OZ-H, $^{i}$PrOH/hexane = 3/97, 1.0 mL/min, 254 nm; $t_r$ (minor) = 30.920 min, $t_r$ (major) = 39.240 min) gave the isomeric composition of the product: 96% ee, $[\alpha]^{27}_{D}$ = -34.1 (c = 1.00, $CHCl_3$); $^{1}$H NMR (400 MHz, $CDCl_3$): δ 7.72 (s, 1H), 7.40-7.38 (m, 2H), 7.33-7.31 (m, 3H), 7.23-7.19 (m, 2H), 7.18-7.16 (m, 2H), 6.68 (dd, *J* = 8.4 Hz, *J* = 2.8 Hz, 1H),

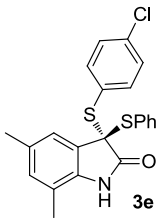
6.57-6.52 (m, 2H), 3.69 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 175.63, 155.51, 137.62, 136.49, 136.25, 132.99, 129.82, 129.25, 129.02, 128.80, 128.63, 128.02, 115.51, 111.16, 110.99, 63.42, 55.67; IR (KBr): 3448, 3178, 1690, 1484, 1304, 1205, 748, 691; HRMS (EI): Exact mass calcd for $C_{21}H_{16}NO_2S_2{}^{35}Cl$ $[M]^+$: 413.0311, Found: 413.0307.



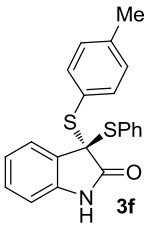

Column chromatography (PE/EtOAc = 6:1 to 3:1) afforded the desired product **3c** in 70% yield as brown solid (m. p. 157-159 $^{o}$C). HPLC analysis (Chiralpak OZ-H, $^{i}$PrOH/hexane = 3/97, 1.0 mL/min, 230 nm; $t_r$ (minor) = 26.940 min, $t_r$ (major) = 29.887 min) gave the isomeric composition of the product: 87% ee, $[\alpha]^{29}_D$ = -15.7 (c = 1.04, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 9.14 (s, 1H), 7.37-7.35 (m, 2H), 7.31-7.26 (m, 3H), 7.19-7.13 (m, 4H), 6.82 (d, *J* = 8.4 Hz, 1H), 6.45 (dd, *J* = 8.4 Hz, *J* = 2.4 Hz, 1H), 6.30 (d, *J* = 2.0 Hz, 1 H), 3.74 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 176.43, 160.98, 140.92, 137.70, 136.50, 136.20, 129.75, 129.46, 128.79, 128.61, 128.20, 126.42, 119.41, 108.09, 96.88, 63.19, 55.47; IR (KBr): 3159, 1734, 1622, 1455, 1311, 1158, 1018, 752; HRMS (EI): Exact mass calcd for $C_{21}H_{16}NO_2S_2{}^{35}Cl$ $[M]^+$: 413.0311, Found: 413.0312.



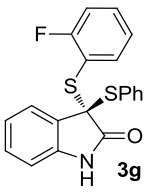

Column chromatography (PE/EtOAc = 6:1 to 3:1) afforded the desired product **3d** in 85% yield as pink solid (m. p. 116-118 $^{o}$C). HPLC analysis (Chiralpak OZ-H, $^{i}$PrOH/hexane = 3/97, 1.0 mL/min, 230 nm; $t_r$ (minor) = 17.500 min, $t_r$ (major) = 20.433 min) gave the isomeric composition of the product: 91% ee, $[\alpha]^{26}_D$ = -11.5 (c = 1.05, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.40 (s, 1H), 7.39-7.38 (m, 1H), 7.37-7.36 (m, 1H), 7.35-7.34 (m, 1H), 7.33-7.31 (m, 2H), 7.24-7.18 (m, 4H), 7.12 (dd, *J* = 7.6 Hz, *J* = 2.0 Hz, 1H), 6.96-6.89 (m, 2 H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 174.20, 137.97, 137.36, 136.74, 136.67, 130.17, 129.60, 129.46, 129.00, 128.91, 128.79, 127.61, 123.89, 123.35, 115.19, 63.47; IR (KBr): 3447, 1715, 1617, 1473, 1457, 1091, 753, 505; HRMS (EI): Exact mass calcd for $C_{20}H_{13}NOS_2{}^{35}Cl_2$ $[M]^+$: 416.9816, Found: 416.9817.




Column chromatography (PE/EtOAc = 6:1 to 3:1) afforded the desired product **3e** in 87% yield as pink solid (m. p. 146-148 $^{o}$C). HPLC analysis (Chiralpak OZ-H, $^{i}$PrOH/hexane = 3/97, 1.0 mL/min, 230 nm; $t_r$ (minor) = 20.853 min, $t_r$ (major) = 24.233 min) gave the isomeric composition of the product: 93% ee, $[\alpha]^{27}_{D}$ = -22.9 (c = 1.00, $CHCl_3$); $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.50 (s, 1H), 7.39-7.38 (m, 1H), 7.37-7.36 (m, 1H), 7.34-7.32 (m, 2H), 7.31-7.29 (m, 1H), 7.21-7.15 (m, 4H), 6.77 (s, 1H), 6.59 (s, 1 H), 2.21 (s, 3 H), 2.04 (s, 3 H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 176.14, 137.77, 136.63, 136.15, 136.08, 131.98, 131.57, 129.76, 129.69, 128.71, 128.54, 128.48, 127.59, 123.47, 119.52, 63.39, 21.06, 16.22; IR (KBr): 3173, 3076, 2919, 1705, 1626, 1475, 828, 508; HRMS (EI): Exact mass calcd for $C_{22}H_{18}NOS_2{}^{35}Cl$ $[M]^+$: 411.0518, Found: 411.0515.

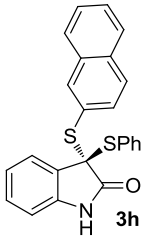



Column chromatography (PE/EtOAc = 6:1 to 3:1) afforded the desired product **3f** in 70% yield as white solid (m. p. 151-153 $^{o}$C). HPLC analysis (Chiralpak AD-H, $^{i}$PrOH/hexane = 10/90, 1.0 mL/min, 230 nm; $t_r$ (minor) = 19.452 min, $t_r$ (major) = 15.965 min) gave the isomeric composition of the product: 88% ee, $[\alpha]^{28}_{D}$ = 5.4 (c = 1.00, $CHCl_3$); $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.37 (s, 1H), 7.36-7.34 (m, 2H), 7.28-7.24 (m, 3H), 7.17-7.13 (m, 2H), 7.10 (td, *J* = 7.6 Hz, *J* = 1.6 Hz, 1 H), 7.01-6.97 (m, 3H), 6.93 (td, *J* = 7.6 Hz, *J* = 1.2 Hz, 1 H), 6.62 (d, *J* = 7.6 Hz, 1H), 2.27 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 176.13, 140.14, 139.83, 136.71, 136.43, 129.79, 129.68, 129.47, 129.34, 128.61, 128.53, 125.98, 125.71, 122.39, 110.30, 63.28, 21.34; IR (KBr): 3410, 3188, 1736, 1693, 1469, 1324, 747, 687; HRMS (EI): Exact mass calcd for $C_{21}H_{17}NOS_2$ $[M]^+$: 363.0752, Found: 363.0754.

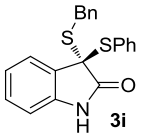



Column chromatography (PE/EtOAc = 6:1 to 3:1) afforded the desired product **3g** in 57% yield as white solid (m. p. 192-194 $^{o}$C). HPLC analysis (Chiralpak OZ-H, $^{i}$PrOH/hexane = 10/90, 1.0 mL/min, 230 nm; $t_r$ (minor) = 11.751 min, $t_r$ (major) = 10.054 min) gave the isomeric composition of the product: 90% ee, $[\alpha]^{28}_{D}$ = -5.9 (c = 0.60, $CHCl_3$); $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.62 (s, 1H), 7.50 (td, *J* = 7.6 Hz, *J* = 1.6 Hz, 1 H), 7.38-7.35 (m, 2H), 7.29-7.26 (m, 2H), 7.19-7.15 (m, 2H), 7.09 (td, *J* = 7.6 Hz, *J* = 1.6 Hz, 1 H), 7.00 (td, *J* = 7.6 Hz, *J* = 1.2 Hz, 1 H), 6.95-6.86 (m, 3H), 6.65 (d, *J* = 7.6 Hz, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ

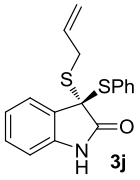
175.32, 163.54 ($J$ = 248 Hz), 139.57, 138.39, 136.60, 132.36 ($J$ = 8 Hz), 129.83, 129.59, 129.53, 128.63, 127.83, 125.81, 124.19 ($J$ = 4 Hz), 122.42, 116.94 ($J$ = 8 Hz), 115.78 ($J$ = 24 Hz), 110.89, 63.01; IR (KBr): 3415, 3187, 1731, 1728, 1469, 1227, 824, 746; HRMS (EI): Exact mass calcd for $C_{20}H_{14}NOS_2F$ $[M]^+$: 367.0501, Found: 367.0507.



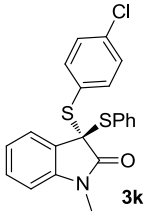

Column chromatography (PE/EtOAc = 6:1 to 3:1) afforded the desired product **3h** in 67% yield as pale pink solid (m. p. 130-132 $^oC$). HPLC analysis (Chiralpak IC, $^i$PrOH/hexane = 10/90, 1.0 mL/min, 230 nm; $t_r$ (minor) = 15.332 min, $t_r$ (major) = 18.502 min) gave the isomeric composition of the product: 87% ee, $[\alpha]^{28}_D$ = -6.0 (c = 1.00, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.89 (s, 1H), 7.75-7.72 (m, 2H), 7.67-7.65 (m, 1H), 7.62-7.60 (m, 1H), 7.47-7.42 (m, 2 H), 7.40-7.38 (m, 3H), 7.29-7.27 (m, 1H), 7.20-7.16 (m, 2H), 7.08-7.05 (m, 2H), 6.94-6.91 (m, 1H), 6.52-6.50 (m, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 175.93, 139.76, 136.91, 136.56, 133.45, 133.17, 132.64, 129.80, 129.64, 129.50, 128.67, 128.42, 128.16, 128.07, 127.62, 127.22, 126.90, 126.37, 125.73, 122.49, 110.32, 63.34; IR (KBr): 3448, 3186, 1751, 1701, 1467, 1182, 746, 481; HRMS (EI): Exact mass calcd for $C_{24}H_{17}NOS_2$ $[M]^+$: 399.0752, Found: 399.0755.



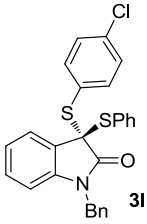

Column chromatography (PE/EtOAc = 10:1 to 5:1) afforded the desired product **3i** in 84% yield as white solid (m. p. 137-139 $^oC$). HPLC analysis (Chiralpak AS-H, $^i$PrOH/hexane = 20/80, 1.0 mL/min, 230 nm; $t_r$ (minor) = 18.567 min, $t_r$ (major) = 16.320 min) gave the isomeric composition of the product: 91% ee, $[\alpha]^{26}_D$ = -0.6 (c = 0.90, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.70 (s, 1H), 7.34-7.33 (m, 1H), 7.32-7.31 (m, 1H), 7.30-7.29 (m, 1H), 7.28-7.27 (m, 3H), 7.26-7.25 (m, 1H), 7.24-7.22 (m, 1H), 7.21-7.20 (m, 1H), 7.19-7.16 (m, 2H), 7.15-7.14 (m, 1H), 7.00 (td, $J$ = 7.6 Hz, $J$ = 1.2 Hz, 1H), 6.71 (d, $J$ = 7.6 Hz, 1H), 4.22, 4.19 (AB, $J$ = 12.0 Hz, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 175.15, 139.31, 136.53, 136.12, 129.78, 129.60, 129.56, 129.43, 128.62, 128.47, 128.43, 127.31, 125.29, 122.83, 109.95, 60.38, 34.83; IR (KBr): 3449, 3241, 1724, 1494, 1232, 747, 702, 498; HRMS (EI): Exact mass calcd for $C_{21}H_{17}NOS_2$ $[M]^+$: 363.0752, Found: 363.0748.



Column chromatography (PE/EtOAc = 10:1 to 5:1) afforded the desired product **3j** in 56% yield as white solid (m. p. 51-53 $^{o}$C). HPLC analysis (Chiralpak OZ-H, $^{i}$PrOH/hexane = 3/97, 1.0 mL/min, 230 nm; $t_r$ (minor) = 10.453 min, $t_r$ (major) = 11.473 min) gave the isomeric composition of the product: 83% ee, $[\alpha]^{29}_{D}$ = -7.2 (c = 1.09, $CHCl_3$); $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.91 (s, br, 1H), 7.34-7.28 (m, 3H), 7.20-7.15 (m, 3H), 7.11 (d, *J* = 6.8 Hz, 1H), 7.00 (td, *J* = 7.6 Hz, *J* = 0.8 Hz, 1H), 6.80 (d, *J* = 7.6 Hz, 1H), 5.86-5.76 (m, 1H), 5.08-5.00 (m, 2H), 3.53 (d, *J* = 6.8 Hz, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 176.11, 139.56, 136.66, 132.83, 129.89, 129.64, 129.47, 128.63, 128.50, 125.29, 122.82, 118.44, 110.26, 60.18, 33.79; IR (KBr): 3448, 1733, 1685, 1522, 1472, 1458 , 1384, 690; HRMS (EI): Exact mass calcd for $C_{17}H_{15}NOS_2$ $[M]^+$: 313.0595, Found: 313.0597.

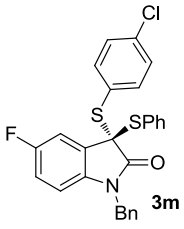


Column chromatography (PE/EtOAc = 20:1 to 15:1) afforded the desired product **3k** in 97% yield as pale pink solid (m. p. 102-104 $^{o}$C). HPLC analysis (Chiralpak AD-H, $^{i}$PrOH/hexane = 3/97, 1.0 mL/min, 230 nm; $t_r$ (minor) = 19.953 min, $t_r$ (major) = 18.033 min) gave the isomeric composition of the product: 90% ee, $[\alpha]^{29}_{D}$ = -26.5 (c = 1.00, $CHCl_3$); $^{1}$H NMR (400 MHz, $CDCl_3$): δ 7.35-7.32 (m, 2H), 7.30-7.27 (m, 3H), 7.20-7.14 (m, 5H), 7.03-7.01 (m, 1H), 6.96 (td, *J* = 7.2 Hz, *J* = 0.8 Hz, 1H), 6.49 (d, *J* = 7.6 Hz, 1H), 2.90 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 173.05, 142.26, 137.89, 136.75, 136.26, 129.85, 129.60, 129.27, 128.70, 128.51, 128.06, 127.73, 125.41, 122.61, 108.05, 62.63, 26.37; IR (KBr): 3421, 3082, 1705, 1607, 1508, 1093, 759, 540; HRMS (EI): Exact mass calcd for $C_{21}H_{16}NOS_2{}^{35}Cl$ $[M]^+$: 397.0362, Found: 397.0360.



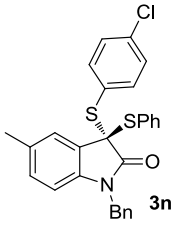
Column chromatography (PE/EtOAc = 20:1 to 15:1) afforded the desired product **3l** in 98% yield as yellow oil. HPLC analysis (Chiralpak AD-H, $^{i}$PrOH/hexane = 3/97, 1.0 mL/min, 230 nm; $t_r$ (minor) = 67.035 min, $t_r$ (major) = 57.884 min) gave the isomeric composition of the product: 94% ee, $[\alpha]^{29}_{D}$ = -36.5 (c = 0.97, $CHCl_3$); $^{1}$H NMR (400 MHz, $CDCl_3$): δ 7.38-7.36 (m, 2H), 7.33-7.31 (m, 1H), 7.28-7.27 (m, 1H), 7.27-7.26 (m, 2H), 7.20 (t, *J* = 1.6 Hz, 1H), 7.19-7.18 (m, 3H), 7.17-7.16 (m, 1H), 7.13-7.11 (m, 2H), 7.05 (td, *J* = 7.6 Hz, *J* = 1.2 Hz, 1H), 6.97 (td, *J* = 7.6 Hz, *J* = 1.2 Hz, 1H), 6.72-6.70 (m, 2H), 6.35 (d, J = 7.6 Hz, 1H), 4.69, 4.55 (AB, *J* = 16.0 Hz, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 172.62, 141.40, 137.88, 136.81, 136.21, 134.71, 129.80, 129.44, 129.03, 128.73, 128.52, 128.46, 127.87, 127.66, 127.30, 126.62, 125.34, 122.52, 109.11, 62.68,

43.85; IR (KBr): 3503, 3038, 1710, 1608, 1467, 1092, 749, 692; HRMS (ESI): Exact mass calcd for $C_{27}H_{21}{}^{35}ClNOS_2$ $[M+H]^+$: 474.0748, Found: 474.0749.



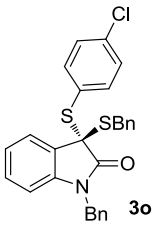
**3m**

Column chromatography (PE/EtOAc = 20:1 to 15:1) afforded the desired product **3m** in 97% yield as pink oil. HPLC analysis (Chiralpak AD-H, $^i$PrOH/hexane = 10/90, 1.0 mL/min, 230 nm; $t_r$ (minor) = 20.867 min, $t_r$ (major) = 18.487 min) gave the isomeric composition of the product: 91% ee, $[\alpha]^{28}{}_D$ = -46.2 (c = 1.04, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.39-7.36 (m, 3H), 7.30-7.28 (m, 2H), 7.23-7.14 (m, 7H), 6.92 (dd, *J* = 8.0 Hz, *J* = 2.8 Hz, 1H), 6.75 (td, *J* = 8.8 Hz, *J* = 2.8 Hz, 1H), 6.69-6.67 (m, 2H), 6.24 (dd, *J* = 8.8 Hz, *J* = 4.4 Hz, 1H), 4.68, 4.53 (AB, *J* = 16.0 Hz, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 172.65, 158.92 (*J* = 240 Hz, 1C), 138.08, 137.48, 137.05, 136.66, 134.55, 130.24, 129.65 (*J* = 2.0 Hz, 1C), 129.07, 128.86, 128.72, 127.63, 116.06 (*J* = 23 Hz, 1C), 113.18 (*J* = 25 Hz, 1C), 110.04, 109.96, 62.91, 44.18; IR (KBr): 3064, 1720, 1610, 1167, 747, 693, 597, 505; HRMS (EI): Exact mass calcd for $C_{27}H_{19}NOS_2{}^{35}ClF$ $[M]^+$: 491.0581, Found: 491.0583.



**3n**

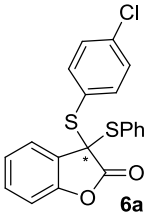
Column chromatography (PE/EtOAc = 20:1 to 15:1) afforded the desired product **3n** in 99% yield as yellow oil. HPLC analysis (Chiralpak AD-H, $^i$PrOH/hexane = 10/90, 1.0 mL/min, 230 nm; $t_r$ (minor) = 19.753 min, $t_r$ (major) = 18.200 min) gave the isomeric composition of the product: 94% ee, $[\alpha]^{27}{}_D$ = -48.1 (c = 1.06, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.38-7.32 (m, 3H), 7.28-7.27 (m, 1H), 7.26-7.25 (m, 1H), 7.21-7.11 (m, 7H), 6.95 (s, 1H), 6.85 (dd, *J* = 8.0 Hz, *J* = 0.8 Hz, 1H), 6.72-6.69 (m, 2H), 6.25 (d, *J* = 8.0 Hz, 1H), 4.68, 4.54 (AB, *J* = 16.0 Hz, 2H), 2.25 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 172.69, 139.18, 138.01, 137.02, 136.31, 135.03, 132.23, 129.94, 129.92, 129.38, 128.86. 128.65, 128.60, 128.25, 127.72, 127.42, 126.81, 126.12, 109.04, 62.89, 44.03, 21.10; IR (KBr): 3427, 3061, 2919, 1723, 1494, 1092, 747, 504; HRMS (EI): Exact mass calcd for $C_{28}H_{22}NOS_2{}^{35}Cl$ $[M]^+$: 487.0831, Found: 487.0828.



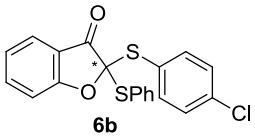
**3o**

Column chromatography (PE/EtOAc = 20:1 to 15:1) afforded the desired product **3o** in 70% yield as orange solid (m. p. 45-47 $^o$C). HPLC analysis (Chiralpak AD-H, $^i$PrOH/hexane = 10/90, 1.0 mL/min, 230 nm; $t_r$ (minor) = 24.613 min, $t_r$ (major) = 13.920

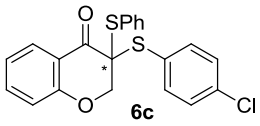
min) gave the isomeric composition of the product: 81% ee, $[\alpha]^{29}_{D}$ = -16.6 (c = 1.05, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.37 (dd, *J* = 7.6 Hz, *J* = 1.2 Hz, 1H), 7.32-7.28 (m, 4H), 7.24-7.19 (m, 6H), 7.15-7.08 (m, 3H), 7.04 (td, *J* = 7.6 Hz, *J* = 1.2 Hz, 1H) 6.83-6.80 (m, 2H), 6.50 (d, *J* = 7.6 Hz, 1H), 4.95, 4.45 (AB, *J* = 15.6 Hz, 2H), 4.34, 4.29 (AB, *J* = 12.0 Hz, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 172.85, 141.41, 137.85, 136.36, 136.20, 135.03, 129.79, 129.51, 129.04, 128.74, 128.60, 128.42, 127.93, 127.62, 127.39, 126.87, 124.95, 123.09, 109.52, 58.89, 44.10, 34.61; IR (KBr): 3448, 2922, 1716, 1606, 1485, 1355, 1092, 696; HRMS (EI): Exact mass calcd for $C_{28}H_{22}NOS_2{}^{35}Cl$ $[M]^+$: 487.0831, Found: 487.0828.




Column chromatography (PE/EtOAc = 20:1 to 15:1) afforded the desired product **6a** in 95% yield as orange solid (m. p. 60-62 $^o$C). HPLC analysis (Chiralpak AD-H, $^i$PrOH/hexane = 3/97, 1.0 mL/min, 230 nm; $t_r$ (minor) = 11.040 min, $t_r$ (major) = 13.853 min) gave the isomeric composition of the product: 87% ee, $[\alpha]^{29}_{D}$ = +13.6 (c = 0.98, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.38-7.30 (m, 5H), 7.24-7.23 (m, 1H), 7.22-7.19 (m, 5H), 7.13-7.09 (m, 1H), 6.82-6.80 (m, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 172.37, 151.94, 138.03, 137.04, 136.83, 130.60, 130.45, 129.20, 128.98, 128.51, 127.20, 126.45, 125.48, 124.49, 110.76, 60.95; IR (KBr): 3448, 1797, 1637, 1463, 1230, 1092, 748, 685; HRMS (EI): Exact mass calcd for $C_{20}H_{13}O_2S_2{}^{35}Cl$ $[M]^+$: 384.0046, Found: 384.0048.

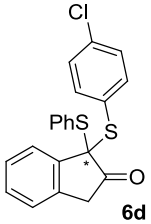



Column chromatography (PE/EtOAc = 20:1 to 15:1) afforded the desired product **6b** in 85% yield as yellow solid (m. p. 69-71 $^o$C). HPLC analysis (Chiralpak OD-H, $^i$PrOH/hexane = 1/99, 1.0 mL/min, 230 nm; $t_r$ (minor) = 16.600 min, $t_r$ (major) = 18.247 min) gave the isomeric composition of the product: 95% ee, $[\alpha]^{29}_{D}$ = -1.3 (c = 1.04, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.55-7.53 (m, 2H), 7.51-7.46 (m, 3H), 7.41 (d, *J* = 7.6 Hz, 1H), 7.29-7.26 (m, 1H), 7.22-7.18 (m, 4H), 6.95-6.90 (m, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 194.05, 169.39, 138.61, 137.79, 136.62, 136.55, 130.04, 129.01, 128.80, 127.80, 126.57, 124.78, 122.72, 119.66, 112.59, 99.24; IR (KBr): 3421, 3080, 1750, 1647, 1474, 1092, 758, 518; HRMS (EI): Exact mass calcd for $C_{20}H_{13}O_2S_2{}^{35}Cl$ $[M]^+$: 384.0046, Found: 384.0049.



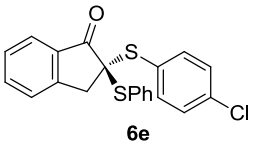
**6c**

Column chromatography (PE/EtOAc = 20:1 to 15:1) afforded the desired product **6c** in 97% yield as pale yellow solid (m. p. 52-54 $^{o}$C). HPLC analysis (Chiralpak IC, $^{i}$PrOH/hexane = 1/99, 1.0 mL/min, 230 nm; $t_r$ (minor) = 17.033 min, $t_r$ (major) = 19.213 min) gave the isomeric composition of the product: 94% ee, $[\alpha]^{29}_{D}$ = +22.6 (c = 0.96, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.89 (dd, *J* = 8.0 Hz, *J* = 1.6 Hz, 1H), 7.59-7.57 (m, 2H), 7.51-7.48 (m, 3H), 7.42-7.39 (m, 1H), 7.35-7.28 (m, 4H), 7.06 (td, *J* = 7.6 Hz, *J* = 1.2 Hz, 1H), 6.94 (dd, *J* = 8.0 Hz, *J* = 0.8 Hz, 1H), 4.42, 4.36 (AB, *J* = 12.4 Hz, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 184.13, 160.08, 138.16, 136.92, 136.57, 136.14, 130.05, 129.18, 129.02, 128.56, 128.46, 127.33, 122.21, 119.50, 117.67, 73.28, 66.48; IR (KBr): 3447, 3074, 2865, 1681, 1601, 1062, 842, 540; HRMS (EI): Exact mass calcd for $C_{21}H_{15}O_2S_2{}^{35}Cl$ $[M]^+$: 398.0202, Found: 398.0203



**6d**

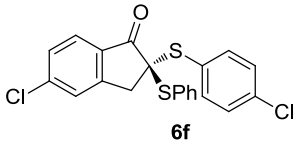
Column chromatography (PE/EtOAc = 20:1 to 15:1) afforded the desired product **6d** in 85% yield as yellow oil. HPLC analysis (Chiralpak OD-H, $^{i}$PrOH/hexane = 1/99, 1.0 mL/min, 230 nm; $t_r$ (minor) = 11.677 min, $t_r$ (major) = 12.746 min) gave the isomeric composition of the product: 91% ee, $[\alpha]^{27}_{D}$ = +24.5 (c = 1.06, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.45 (d, *J* = 7.2 Hz, 1H), 7.30-7.29 (m, 1H), 7.29-7.28 (m, 2H), 7.27-7.26 (m, 1H), 7.26-7.25 (m, 1H), 7.23-7.22 (m, 2H), 7.20-7.13 (m, 4H), 7.08 (d, *J* = 7.6 Hz, 1H), 3.24 (s, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 206.83, 139.85, 137.66, 136.50, 136.12, 135.71, 129.99, 129.69, 129.35, 128.89, 128.81, 128.71, 127.85, 126.52, 124.65, 68.58, 40.80; IR (KBr): 3481, 3058, 1752, 1474, 1092, 1014, 745, 550; HRMS (EI): Exact mass calcd for $C_{21}H_{15}OS_2{}^{35}Cl$ $[M]^+$: 382.0253, Found: 382.0249.



**6e**

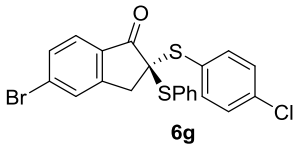
Column chromatography (PE/EtOAc = 20:1 to 15:1) afforded the desired product **6e** in 95% yield as orange solid (m. p. 90-92 $^{o}$C). HPLC analysis (Chiralpak OD-H, $^{i}$PrOH/hexane = 1/99, 1.0 mL/min, 230 nm; $t_r$ (minor) = 16.760 min, $t_r$ (major) = 15.387 min) gave the isomeric composition of the product: 95% ee, $[\alpha]^{29}_{D}$ = +26.4 (c = 0.95, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.78 (d, *J* = 7.6 Hz, 1H), 7.58-7.50 (m, 5H), 7.40-7.23 (m, 7H), 3.44, 3.35 (AB, *J* = 18.0 Hz, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 196.66, 148.89, 137.21, 136.01, 135.71, 135.35, 133.72, 130.94, 129.48, 129.45, 129.02, 128.87, 128.19, 125.86, 125.35, 67.00, 41.87; IR (KBr): 3448, 1708, 1647, 1465, 1092, 1025, 746, 688;

HRMS (EI): Exact mass calcd for $C_{21}H_{15}OS_2{}^{35}Cl$ $[M]^+$: 382.0253, Found: 382.0250.



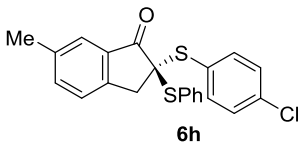
**6f**

Column chromatography (PE/EtOAc = 20:1 to 15:1) afforded the desired product **6f** in 96% yield as yellow solid (m. p. 121-123 $^oC$). HPLC analysis (Chiralpak AD-H, $^i$PrOH/hexane = 3/97, 1.0 mL/min, 230 nm; $t_r$ (minor) = 23.873 min, $t_r$ (major) = 22.227 min) gave the isomeric composition of the product: 90% ee, $[\alpha]^{29}_D$ = +42.9 (c = 0.96, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.70 (d, *J* = 8.4 Hz, 1H), 7.56-7.54 (m, 2H), 7.51-7.49 (m, 2H), 7.37-7.35 (m, 2H), 7.33-7.28 (m, 4H), 7.24 (s, 1H), 3.39, 3.30 (AB, *J* = 18.0 Hz, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 195.33, 150.39, 141.93, 137.35, 136.27, 135.86, 132.23, 130.69, 129.72, 129.23, 129.18, 129.07, 129.04, 126.49, 126.22, 67.02, 41.49; IR (KBr): 3449, 1703, 1600, 1477, 1261, 1069, 744, 486; HRMS (EI): Exact mass calcd for $C_{21}H_{14}OS_2{}^{35}Cl_2$ $[M]^+$: 415.9863, Found: 415.9860.



**6g**

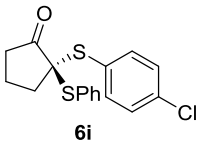
Column chromatography (PE/EtOAc = 20:1 to 15:1) afforded the desired product **6g** in 93% yield as orange solid (m. p. 155-157 $^oC$). HPLC analysis (Chiralpak AD-H, $^i$PrOH/hexane = 3/97, 1.0 mL/min, 230 nm; $t_r$ (minor) = 28.926 min, $t_r$ (major) = 26.484 min) gave the isomeric composition of the product: 92% ee, $[\alpha]^{29}_D$ = +41.1 (c = 1.0, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.63 (d, *J* = 8.4 Hz, 1H), 7.56-7.49 (m, 5H), 7.42 (s, 1H), 7.38-7.36 (m, 1H), 7.33-7.28 (m, 4H), 3.39, 3.31 (AB, *J* = 18.0 Hz, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 195.49, 150.45, 137.34, 136.29, 135.86, 132.63, 131.92, 130.76, 130.66, 129.72, 129.26, 129.18, 129.03, 126.55, 66.91, 41.39; IR (KBr): 3448, 1704, 1592, 1474, 1024, 968, 825, 746; HRMS (EI): Exact mass calcd for $C_{21}H_{14}OS_2{}^{35}Cl^{79}Br$ $[M]^+$: 459.9358, Found: 459.9354.



**6h**

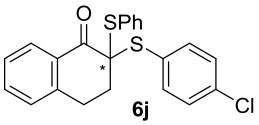
Column chromatography (PE/EtOAc = 20:1 to 15:1) afforded the desired product **6h** in 95% yield as pink solid (m. p. 71-73 $^oC$). HPLC analysis (Chiralpak AD-H, $^i$PrOH/hexane = 3/97, 1.0 mL/min, 230 nm; $t_r$ (minor) = 22.556 min, $t_r$ (major) = 24.207 min) gave the isomeric composition of the product: 94% ee, $[\alpha]^{28}_D$ = +27.5 (c = 1.02, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.58-7.55 (m, 3H), 7.52-7.50 (m, 2H), 7.39-7.26 (m, 6H), 7.13 (d, *J* = 7.6 Hz, 1H), 3.39, 3.30 (AB, *J* = 17.6 Hz, 2H), 2.39 (s, 3H); $^{13}$C NMR

(100 MHz, $CDCl_3$): δ 196.73, 146.26, 138.33, 137.23, 136.70, 135.98, 135.71, 133.83, 131.13, 129.68, 129.45, 129.06, 128.93, 125.67, 125.32, 67.41, 41.60, 21.20; IR (KBr): 3449, 1705, 1495, 1281, 1091, 815, 743, 688; HRMS (EI): Exact mass calcd for $C_{22}H_{17}OS_2{}^{35}Cl$ $[M]^+$: 396.0409, Found: 396.0407.



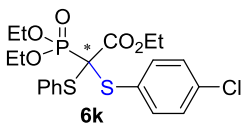
**6i**

Column chromatography (PE/EtOAc = 20:1 to 15:1) afforded the desired product **6i** in 80% yield as yellow oil. HPLC analysis (Chiralpak OD-H, $^i$PrOH/hexane = 5/95, 1.0 mL/min, 230 nm; $t_r$ (minor) = 8.477 min, $t_r$ (major) = 7.632 min) gave the isomeric composition of the product: 86% ee, $[\alpha]^{29}_D$ = -8.7 (c = 0.92, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.59-7.57 (m, 2H), 7.53-7.51 (m, 2H), 7.40-7.31 (m, 5H), 2.36 (t, *J* = 7.6 Hz, 2H), 2.16-2.05 (m, 2H), 2.02-1.95 (m, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 206.71, 137.57, 136.20, 136.08, 130.46, 129.60, 129.16, 129.11, 128.95, 69.27, 36.92, 35.63, 18.32; IR (KBr): 3448, 2968, 1733, 1474, 1024, 823, 745, 492; HRMS (EI): Exact mass calcd for $C_{17}H_{15}OS_2{}^{35}Cl$ $[M]^+$: 334.0253, Found: 334.0256.



**6j**

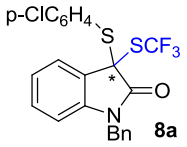
Column chromatography (PE/EtOAc = 20:1 to 15:1) afforded product **6j** in 80% yield as light green oil. HPLC analysis (Chiralpak AD-H, $^i$PrOH/hexane = 3/97, 1.0 mL/min, 230 nm; $t_r$ (minor) = 15.927 min, $t_r$ (major) = 16.753 min) gave the isomeric composition of the product: 97% ee, $[\alpha]^{28}_D$ = +8.5 (c = 0.95, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 8.02 (dd, *J* = 8.0 Hz, *J* = 1.2 Hz, 1H), 7.60-7.57 (m, 2H), 7.53-7.48 (m, 3H), 7.40-7.38 (m, 1H), 7.36-7.29 (m, 5H), 7.21 (d, *J* = 7.6 Hz, 1H), 3.11 (t, *J* = 6.0 Hz, 2H), 2.40-2.36 (m, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 188.45, 142.18, 138.06, 136.80, 136.11, 133.62, 130.92, 130.09, 129.64, 129.02, 128.88, 128.83, 128.52, 127.11, 70.57, 35.62, 26.71; IR (KBr): 3446, 3057, 2926, 1684, 1474, 1234, 744, 511; HRMS (EI): Exact mass calcd for $C_{22}H_{17}OS_2{}^{35}Cl$ $[M]^+$: 396.0409, Found: 396.0410.



**6k**

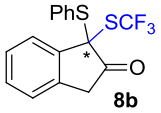
Column chromatography (PE/EtOAc = 4:1 to 2:1) afforded the desired product **6k** in 94% yield as colorless oil. HPLC analysis (Chiralpak AD-H, $^i$PrOH/hexane = 10/90, 1.0 mL/min, 205 nm; $t_r$ (minor) = 8.751 min, $t_r$ (major) = 9.755 min) gave the isomeric composition of the product: 70% ee, $[\alpha]^{28}_D$ = -18.0 (c = 1.02, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.68-7.64 (m, 4H), 7.36-7.25 (m, 5H), 4.31-4.20 (m, 4H), 3.88 (q, *J* = 7.2 Hz, 2H), 1.33-1.28

(m, 6H), 1.00 (t, $J$ = 7.2 Hz, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 165.58 (d, $J$ = 3 Hz, 1C), 137.70, 135.98, 130.71, 130.66, 129.60, 129.57, 129.54, 128.54, 65.16 (d, $J$ = 149 Hz, 1C), 64.74 (d, $J$ = 2 Hz, 1C), 64.67 (d, $J$ = 2 Hz, 1C), 62.81, 16.38, 16.33, 13.56; $^{31}$P NMR (161.7 MHz, CDCl3): 13.91 (s, 1P); IR (KBr): 3448, 2982, 2929, 1723, 1475, 1258, 1026, 748; HRMS (EI): Exact mass calcd for $C_{20}H_{24}O_5S_2P^{35}Cl$ $[M]^+$: 474.0491, Found: 474.0488.



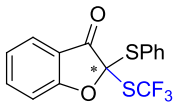
**8a**

Column chromatography (PE/EtOAc = 20:1 to 15:1) afforded the desired product **8a** in 65% yield as pale brown solid (m. p. 92-94 $^{o}$C). HPLC analysis (Chiralpak AD-H, $^{i}$PrOH/hexane = 5/95, 1.0 mL/min, 230 nm; $t_r$ (minor) = 13.313 min, $t_r$ (major) = 14.893 min) gave the isomeric composition of the product: 85% ee, $[\alpha]^{29}_D$ = +0.4 (c = 0.94, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.35-7.32 (m, 3H), 7.31-7.25 (m, 4H), 7.24-7.20 (m, 3H), 7.06-7.04 (m, 1H), 6.99 (td, $J$ = 7.6 Hz, $J$ = 0.8 Hz, 1H), 6.71 (d, $J$ = 8.0 Hz, 1H), 4.94, 4.86 (AB, $J$ = 15.6 Hz, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 171.78, 141.32, 139.13, 137.83, 135.01, 130.65, 129.23, 128.87, 128.13 (q, $J$ = 311 Hz, 1C), 127.89, 127.22, 125.82, 125.75, 125.36, 122.94, 109.90, 59.27, 44.57; $^{19}$F NMR (376 MHz, CDCl3): -39.11 (s, 3F). IR (KBr): 3447, 3064, 2922, 1728, 1522, 1097, 748, 500; HRMS (ESI): Exact mass calcd for $C_{22}H_{19}{}^{35}ClF_3N_2OS_2$ $[M+NH_4]^+$: 483.0574, Found: 483.0577.



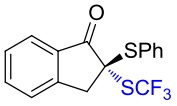
**8b**

Column chromatography (PE/$CH_2Cl_2$ = 10:1 to 5:1) afforded the desired product **8b** in 65% yield as yellow oil. HPLC analysis (Chiralpak OD-H, $^{i}$PrOH/hexane = 1/99, 1.0 mL/min, 230 nm; $t_r$ (minor) = 8.276 min, $t_r$ (major) = 6.826 min) gave the isomeric composition of the product: 83% ee, $[\alpha]^{29}_D$ = +15.4 (c = 1.10, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.48-7.44 (m, 1H), 7.39-7.31 (m, 6H), 7.28-7.22 (m, 2H), 3.87, 3.61 (AB, $J$ = 22.4 Hz, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 203.72, 137.89, 137.68, 135.15, 131.02, 130.06, 129.06, 128.30 (q, $J$ = 311 Hz, 1C), 127.96, 127.81, 126.40, 125.00, 65.61, 39.55; $^{19}$F NMR (376 MHz, CDCl3): -38.23 (s, 3F). IR (KBr): 3447, 3064, 2919, 1762, 1473, 1109, 749, 493; HRMS (EI): Exact mass calcd for $C_{16}H_{11}OF_3S_2$ $[M]^+$: 340.0203, Found: 340.0201.



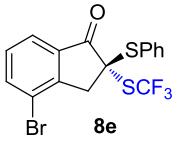
**8c**

Column chromatography (PE/$CH_2Cl_2$ = 10:1 to 5:1) afforded the desired product **8c** in 48% yield as colorless oil. HPLC analysis (Chiralpak OJ-H, $^{i}$PrOH/hexane = 20/80, 1.0 mL/min, 230 nm; $t_r$ (minor) = 10.706 min, $t_r$ (major) = 12.356 min) gave the isomeric composition of the product: 95% ee, $[\alpha]^{27}_{D}$ = +95.8 (c = 0.26, $CHCl_3$); $^{1}$H NMR (400 MHz, acetone-$d_6$): δ 7.90-7.86 (m, 1H), 7.77-7.75 (m, 1H), 7.66-7.63 (m, 2H), 7.55-7.51 (m, 1H), 7.46-7.43 (m, 2H), 7.35-7.30 (m, 2H); $^{13}$C NMR (100 MHz, acetone-$d_6$): δ 192.11, 169.38, 140.72, 138.08, 132.00, 130.25, 129.12 (q, *J* = 310 Hz, 1C), 127.18, 126.17, 125.22, 118.93, 114.46, 96.22; $^{19}$F NMR (376 MHz, acetone-$d_6$): 138.26. IR (KBr): 3447, 1750, 1647, 1522, 1322, 1112, 750, 490; HRMS (EI): Exact mass calcd for $C_{15}H_9O_2F_3S_2$ $[M]^+$: 341.9996, Found: 341.9995.



**8d**

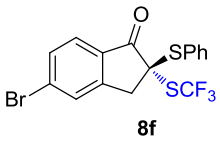
Column chromatography (PE/$CH_2Cl_2$ = 10:1 to 5:1) afforded the desired product **8d** in 64% yield as yellow oil. HPLC analysis (Chiralpak OD-H, $^{i}$PrOH/hexane = 1/99, 1.0 mL/min, 230 nm; $t_r$ (minor) = 7.707 min, $t_r$ (major) = 6.733 min) gave the isomeric composition of the product: 92% ee, $[\alpha]^{27}_{D}$ = -117.9 (c = 1.03, $CHCl_3$); $^{1}$H NMR (400 MHz, $CDCl_3$): δ 7.85 (d, *J* = 7.6 Hz, 1H), 7.66 (td, *J* = 7.6 Hz, *J* = 1.2 Hz, 1H), 7.51-7.44 (m, 4H), 7.40-7.34 (m, 3H), 3.87, 3.58 (AB, *J* = 18.0 Hz, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 194.33, 148.37, 137.25, 135.88, 132.53, 130.73, 129.44 (q, *J* = 310 Hz, 1C), 129.00, 128.89, 128.62, 126.09, 125.77, 64.96, 42.95; $^{19}$F NMR (376 MHz, CDCl3): -37.14 (s, 3F). IR (KBr): 3448, 3059, 2927, 1729, 1606, 1109, 747, 471; HRMS (EI): Exact mass calcd for $C_{16}H_{11}OF_3S_2$ $[M]^+$: 340.0203, Found: 340.0206.



**8e**

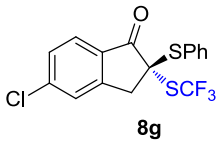
Column chromatography (PE/$CH_2Cl_2$ = 10:1 to 5:1) afforded the desired product **8e** in 64% yield as yellow oil. HPLC analysis (Chiralpak OD-H, $^{i}$PrOH/hexane = 1/99, 1.0 mL/min, 230 nm; $t_r$ (minor) = 7.873 min, $t_r$ (major) = 6.633 min) gave the isomeric composition of the product: 93% ee, $[\alpha]^{28}_{D}$ = -96.7 (c = 0.96, $CHCl_3$); $^{1}$H NMR (400 MHz, acetone-$d_6$): δ 7.99 (dd, *J* = 7.6 Hz, *J* = 0.8 Hz, 1H), 7.84 (dd, *J* = 7.2 Hz, *J* = 0.4 Hz, 1H), 7.57-7.50 (m, 4H), 7.46-7.42 (m, 2H), 3.78, 3.60 (AB, *J* = 18.4 Hz, 2H); $^{13}$C NMR (100 MHz, acetone-$d_6$): δ 193.96, 148.74, 139.75, 138.10, 135.47, 131.94, 131.89, 130.42 (q, *J* = 309 Hz, 1C) 130.15, 129.26, 125.30, 121.86, 65.68, 44.31; $^{19}$F NMR (376 MHz, acetone-$d_6$): -139.46 (s, 3F). IR (KBr): 3447, 1716, 1653, 1541, 1522, 1489, 1386, 1108; HRMS (EI): Exact mass calcd for $C_{16}H_{10}OF_3S_2{}^{79}Br[M]^+$: 417.9309,

Found: 417.9307.



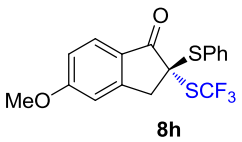
**8f**

Column chromatography (PE/$CH_2Cl_2$ = 10:1 to 5:1) afforded the desired product **8f** in 71% yield as white solid (m. p. 45-47 $^oC$). HPLC analysis (Chiralpak AD-H, $^i$PrOH/hexane = 1/99, 1.0 mL/min, 230 nm; $t_r$ (minor) = 8.193 min, $t_r$ (major) = 6.847 min) gave the isomeric composition of the product: 93% ee, $[\alpha]^{27}_D$ = -117.8 (c = 0.25, $CHCl_3$); $^1$H NMR (400 MHz, acetone-$d_6$): δ 7.84-7.83 (m, 1H), 7.77-7.73 (m, 2H), 7.56-7.52 (m, 3H), 7.46-7.42 (m, 2H), 3.92, 3.74 (AB, *J* = 18.8 Hz, 2H); $^{13}$C NMR (100 MHz, acetone-$d_6$): δ 193.77, 151.35, 138.06, 133.19, 132.25, 131.80, 131.59, 130.78, 130.45 (q, *J* = 309 Hz, 1C), 130.09, 129.47, 127.57, 65.90, 43.10; $^{19}$F NMR (376 MHz, acetone-$d_6$): -139.34 (s, 3F). IR (KBr): 3421, 2924, 1717, 1596, 1318, 1105, 753, 484; HRMS (ESI): Exact mass calcd for $C_{16}H_{14}{}^{79}BrF_3NOS_2$ $[M+NH_4]^+$: 435.9647, Found: 435.9649.



**8g**

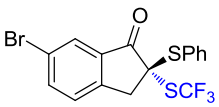
Column chromatography (PE/$CH_2Cl_2$ = 10:1 to 5:1) afforded the desired product **8g** in 70% yield as pale yellow solid (m. p. 68-70 $^oC$). HPLC analysis (Chiralpak AD-H, $^i$PrOH/hexane = 1/99, 1.0 mL/min, 230 nm; $t_r$ (minor) = 9.935 min, $t_r$ (major) = 8.172 min) gave the isomeric composition of the product: 93% ee, $[\alpha]^{27}_D$ = -67.6 (c = 0.24, $CHCl_3$); $^1$H NMR (400 MHz, acetone-$d_6$): δ 7.82 (d, *J* = 8.0 Hz, 1H), 7.66-7.65 (m, 1H), 7.60-7.58 (m, 1H), 7.55-7.52 (m, 3H), 7.46-7.42 (m, 2H), 3.91, 3.73 (AB, *J* = 18.4 Hz, 2H); $^{13}$C NMR (100 MHz, acetone-$d_6$): δ 193.56, 151.29, 142.75, 138.05, 131.89, 131.79, 130.45 (q, *J* = 308 Hz, 1C) 130.30, 130.08, 129.48, 127.70, 127.54, 65.98, 43.18; $^{19}$F NMR (376 MHz, acetone-$d_6$): -139.36 (s, 3F). IR (KBr): 3421, 2963, 1710, 1601, 1109, 887, 752, 492; HRMS (ESI): Exact mass calcd for $C_{16}H_{14}{}^{35}ClF_3NOS_2$ $[M+NH_4]^+$: 392.0152, Found: 392.0154.



**8h**

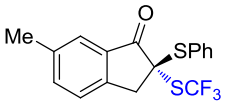
Column chromatography (PE/EtOAc = 15:1 to 10:1) afforded the desired product **8h** in 60% yield as pale yellow solid (m. p. 74-76 $^oC$). HPLC analysis (Chiralpak OD-H, $^i$PrOH/hexane = 0.5/99.5, 1.0 mL/min, 230 nm; $t_r$ (minor) = 24.200 min, $t_r$ (major) = 19.933 min) gave the isomeric composition of the product: 93% ee, $[\alpha]^{29}_D$ = -198.7 (c = 1.03, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.78 (d, *J* = 8.4 Hz, 1H), 7.52-7.50 (m, 2H), 7.47-7.44 (m, 1H), 7.39-7.35 (m, 2H), 6.98 (dd, *J* = 8.4 Hz, *J* = 2.0 Hz, 1H), 6.82 (s, 1H), 3.90 (s, 3H), 3.81, 3.54 (AB, *J* =

18.0 Hz, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 193.04, 166.32, 151.50, 137.13, 130.57, 129.44 (q, *J* = 310 Hz, 1C), 129.15, 128.96, 127.53, 125.37, 116.47, 109.46, 65.16, 55.83, 42.89; $^{19}$F NMR (376 MHz, $CDCl_3$): -37.35 (s, 3F). IR (KBr): 3421, 2944, 1716, 1599, 1262, 1107, 752, 436; HRMS (EI): Exact mass calcd for $C_{17}H_{13}O_2F_3S_2$ [M]$^+$: 370.0309, Found: 370.0305.



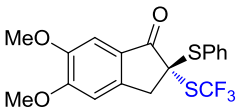
**8i**

Column chromatography (PE/$CH_2Cl_2$ = 10:1 to 5:1) afforded the desired product **8i** in 60% yield as pale yellow solid (m. p. 82-84 °C). HPLC analysis (Chiralpak AD-H+AD-H, $^i$PrOH/hexane = 0.5/99.5, 1.0 mL/min, 230 nm; $t_r$ (minor) = 25.140 min, $t_r$ (major) = 24.202 min) gave the isomeric composition of the product: 92% ee, $[\alpha]^{29}_D$ = -115.9 (c = 0.93, $CHCl_3$); $^1$H NMR (400 MHz, acetone-$d_6$): δ 7.93-7.91 (m, 2H), 7.58-7.52 (m, 4H), 7.46-7.42 (m, 2H), 3.87, 3.69 (AB, *J* = 18.8 Hz, 2H); $^{13}$C NMR (100 MHz, acetone-$d_6$): δ 193.36, 148.40, 139.64, 138.12, 135.19, 131.84, 130.44 (q, *J* = 309 Hz, 1C), 130.09, 129.59, 129.38, 128.60, 123.00, 66.11, 43.23; $^{19}$F NMR (376 MHz, acetone-$d_6$): -139.42 (s, 3F). IR (KBr): 3451, 2921, 1726, 1467, 1104, 895, 753, 489; HRMS (EI): Exact mass calcd for $C_{16}H_{10}OF_3S_2{}^{79}Br$ [M]$^+$: 417.9309, Found: 417.9312.



**8j**

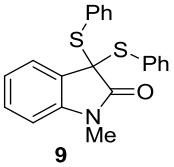
Column chromatography (PE/$CH_2Cl_2$ = 10:1 to 5:1) afforded the desired product **8j** in 68% yield as pale yellow solid (m. p. 47-49 °C). HPLC analysis (Chiralpak OD-H+OD-H, $^i$PrOH/hexane = 1/99, 1.0 mL/min, 230 nm; $t_r$ (minor) = 13.367 min, $t_r$ (major) = 11.600 min) gave the isomeric composition of the product: 94% ee, $[\alpha]^{27}_D$ = -156.7 (c = 0.95, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): δ 7.65 (s, 1H), 7.50-7.45 (m, 4H), 7.39-7.36 (m, 2H), 7.29 (d, *J* = 7.6 Hz, 1H), 3.82, 3.53 (AB, *J* = 18.0 Hz, 2H), 2.44 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 194.41, 145.68, 138.77, 137.25, 137.15, 132.59, 130.68, 129.44 (q, *J* = 309 Hz, 1C), 128.98, 125.80, 125.68, 65.26, 42.63, 21.18; $^{19}$F NMR (376 MHz, $CDCl_3$): δ −37.24 (s, 3F). IR (KBr): 3422, 2918, 1727, 1278, 1102, 896, 796, 491; HRMS (EI): Exact mass calcd for $C_{17}H_{13}OF_3S_2$ [M]$^+$: 354.0360, Found: 354.0359.



**8k**

Column chromatography (PE/EtOAc = 10 to 5:1) afforded the desired product **8k** in 68% yield as orange solid (m. p. 99-101 °C). HPLC analysis (Chiralpak AD-H, $^i$PrOH/hexane = 10/90, 1.0 mL/min, 230 nm; $t_r$ (minor) = 10.253 min, $t_r$ (major) = 8.840 min) gave the isomeric composition of the product: 94% ee, $[\alpha]^{27}_D$ = -162.6 (c = 0.96, $CHCl_3$); $^1$H

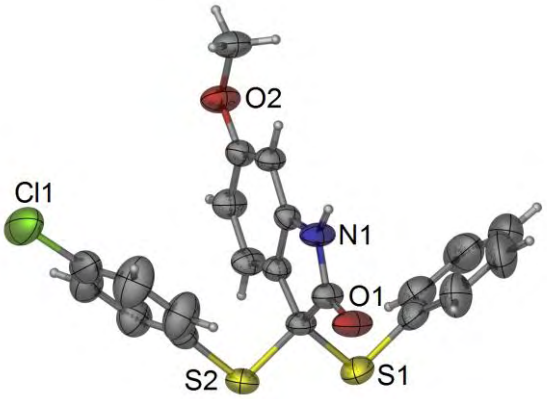
NMR (400 MHz, $CDCl_3$): δ 7.54-7.52 (m, 2H), 7.45-7.44 (m, 1H), 7.39-7.36 (m, 2H), 7.25 (s, 1H), 6.80 (s, 1H), 3.98 (s, 3H), 3.94 (s, 3H), 3.78, 3.52 (AB, *J* = 18.0 Hz, 2H); $^{13}C$ NMR (100 MHz, $CDCl_3$): δ 193.63, 156.60, 150.27, 143.96, 137.12, 130.53, 129.38 (q, *J* = 310 Hz, 1C), 129.15, 128.93, 124.99, 107.01, 105.79, 64.94, 56.39, 56.22, 42.65; $^{19}F$ NMR (376 MHz, $CDCl_3$): δ −37.50 (s, 3F). IR (KBr): 3449, 2940, 1711, 1590, 1311, 1268, 756, 464; HRMS (EI): Exact mass calcd for $C_{18}H_{15}O_3F_3S_2$ $[M]^+$: 400.0415, Found: 400.0414.



**9**

The reaction of 3-thiooxindole **1k** with N-chlorosuccinimide (NCS) catalyzed by DABCO at 25 $^oC$ afforded **9** in 30% yield as orange solid. $^1H$ NMR (400 MHz, $CDCl_3$): δ 7.36-7.33 (m, 4H), 7.29-7.25 (m, 2H), 7.18-7.09 (m, 5H), 6.99-6.90 (m, 2H), 6.45 (d, *J* = 7.6 Hz, 1H), 2.87 (s, 3H); $^{13}C$ NMR (100 MHz, $CDCl_3$): δ 173.28, 142.30, 136.71, 129.69, 129.57, 129.30, 128.43, 128.08, 125.52, 122.43, 107.81, 62.81, 26.30; HRMS (EI): Exact mass calcd for $C_{21}H_{17}NOS_2$ $[M]^+$: 363.0752, Found: 363.0749.

**4) Single-Crystal X-ray Crystallography of 3c.**[13]




Data intensity of **3c** was collected using a Bruker SMART APEX II (Mo radiation) at 296 K in a nitrogen stream. Data collection and reduction were done by using the Bruker ApexII software package. The structures were solved by direct methods and refined by full-matrix least-squares on $F^2$ with anisotropic displacement parameters for non-H atoms using SHELX-97. Hydrogen atoms were added at their geometrically idea positions and refined isotropically. Crystal data for **3c**: $C_{21}H_{16}ClNO_2S_2$, $T$ = 296(2) K, orthorhombic, space group P2(1)2(1)2(1), a = 8.7074(4) Å , b = 12.6241(6) Å , c = 18.0261(8) Å , alpha = 90 deg, beta = 90 deg, gamma = 90 deg. $V$ = 1981.48(16) Å$^3$. Z = 4, $d_{calc}$ = 1.387 mg/m$^3$. Total number of reflections 23460 [R(int) = 0.0900], $R_1$ = 0.0423 ($I > 2\sigma(I)$), $wR_2$ = 0.0939 (all data), GOF = 0.943, and 244 parameters.

Table 1. Crystal data and structure refinement for z.

| | |
|---|---|
| Identification code | z |
| Empirical formula | C21 H16 Cl N O2 S2 |
| Formula weight | 413.92 |
| Temperature | 296(2) K |
| Wavelength | 0.71073 A |
| Crystal system, space group | Orthorhombic, P2(1)2(1)2(1) |
| Unit cell dimensions | a = 8.7074(4) A alpha = 90 deg.<br>b = 12.6241(6) A beta = 90 deg.<br>c = 18.0261(8) A gamma = 90 deg. |
| Volume | 1981.48(16) A^3 |
| Z, Calculated density | 4, 1.387 Mg/m^3 |
| Absorption coefficient | 0.420 mm^-1 |
| F(000) | 856 |
| Crystal size | 0.27 x 0.18 x 0.17 mm |
| Theta range for data collection | 1.97 to 25.01 deg. |

[13] Supplementary crystallographic data have been deposited at the Cambridge Crystallographic Data Center. (CCDC 1413662).

| | |
|---|---|
| Limiting indices | -10<=h<=10, -15<=k<=14, -21<=l<=21 |
| Reflections collected / unique | 23460 / 3490 [R(int) = 0.0900] |
| Completeness to theta = 25.01 | 100.0 % |
| Absorption correction | Semi-empirical from equivalents |
| Max. and min. transmission | 0.9321 and 0.8952 |
| Refinement method | Full-matrix least-squares on F^2 |
| Data / restraints / parameters | 3490 / 0 / 244 |
| Goodness-of-fit on F^2 | 0.943 |
| Final R indices [I>2sigma(I)] | R1 = 0.0423, wR2 = 0.0848 |
| R indices (all data) | R1 = 0.0631, wR2 = 0.0939 |
| Absolute structure parameter | -0.03(7) |
| Largest diff. peak and hole | 0.216 and -0.256 e.A^-3 |

Table 2. Atomic coordinates ( x 10^4) and equivalent isotropic displacement parameters (A^2 x 10^3) for z.
U(eq) is defined as one third of the trace of the orthogonalized Uij tensor.

| | x | y | z | U(eq) |
|---|---|---|---|---|
| S(1) | 2349(1) | 630(1) | -615(1) | 57(1) |
| S(2) | 2504(1) | 1099(1) | 929(1) | 55(1) |
| Cl(1) | -1441(1) | 1178(1) | 3828(1) | 100(1) |
| O(1) | 525(2) | 2728(2) | -61(1) | 60(1) |
| O(2) | -3812(2) | -1864(2) | 806(1) | 60(1) |
| N(1) | -1382(3) | 1531(2) | 195(1) | 46(1) |
| C(1) | 240(5) | 1208(4) | -1670(2) | 81(1) |
| C(2) | -752(6) | 1005(6) | -2256(2) | 104(2) |
| C(3) | -971(6) | -16(6) | -2513(3) | 109(2) |
| C(4) | -230(6) | -814(5) | -2172(3) | 101(2) |
| C(5) | 764(4) | -637(3) | -1579(2) | 73(1) |
| C(6) | 989(4) | 387(3) | -1329(2) | 56(1) |
| C(7) | 1092(3) | 847(2) | 182(2) | 41(1) |
| C(8) | 82(3) | 1839(2) | 85(2) | 44(1) |
| C(9) | -1495(3) | 442(2) | 356(2) | 36(1) |
| C(10) | -2811(3) | -117(2) | 501(2) | 43(1) |
| C(11) | -2636(3) | -1193(2) | 655(2) | 42(1) |
| C(12) | -1193(3) | -1661(2) | 645(2) | 51(1) |
| C(13) | 101(3) | -1073(2) | 488(2) | 48(1) |
| C(14) | -47(3) | -7(2) | 350(2) | 40(1) |
| C(15) | -5334(3) | -1455(3) | 792(2) | 64(1) |
| C(16) | 1306(4) | 1109(3) | 1719(2) | 50(1) |
| C(17) | 574(5) | 2006(3) | 1948(2) | 83(1) |

| | | | | |
|---|---|---|---|---|
| C(18) | -295(6) | 2024(4) | 2580(3) | 95(2) |
| C(19) | -401(4) | 1147(4) | 3009(2) | 68(1) |
| C(20) | 307(5) | 245(3) | 2792(2) | 72(1) |
| C(21) | 1167(5) | 226(3) | 2157(2) | 68(1) |

Table 3. Bond lengths [A] and angles [deg] for z.

| | |
|---|---|
| S(1)-C(6) | 1.777(4) |
| S(1)-C(7) | 1.827(3) |
| S(2)-C(16) | 1.765(3) |
| S(2)-C(7) | 1.852(3) |
| Cl(1)-C(19) | 1.731(4) |
| O(1)-C(8) | 1.215(3) |
| O(2)-C(11) | 1.357(3) |
| O(2)-C(15) | 1.423(4) |
| N(1)-C(8) | 1.348(4) |
| N(1)-C(9) | 1.408(3) |
| N(1)-H(1A) | 0.8600 |
| C(1)-C(6) | 1.370(5) |
| C(1)-C(2) | 1.389(6) |
| C(1)-H(1B) | 0.9300 |
| C(2)-C(3) | 1.383(7) |
| C(2)-H(2A) | 0.9300 |
| C(3)-C(4) | 1.344(7) |
| C(3)-H(3A) | 0.9300 |
| C(4)-C(5) | 1.394(6) |
| C(4)-H(4A) | 0.9300 |
| C(5)-C(6) | 1.383(5) |
| C(5)-H(5A) | 0.9300 |
| C(7)-C(14) | 1.495(4) |
| C(7)-C(8) | 1.541(4) |
| C(9)-C(10) | 1.371(4) |
| C(9)-C(14) | 1.382(4) |
| C(10)-C(11) | 1.395(4) |
| C(10)-H(10A) | 0.9300 |
| C(11)-C(12) | 1.390(4) |
| C(12)-C(13) | 1.379(4) |
| C(12)-H(12A) | 0.9300 |
| C(13)-C(14) | 1.375(4) |
| C(13)-H(13A) | 0.9300 |
| C(15)-H(15A) | 0.9600 |
| C(15)-H(15B) | 0.9600 |

| | |
|---|---|
| C(15)-H(15C) | 0.9600 |
| C(16)-C(17) | 1.362(5) |
| C(16)-C(21) | 1.372(5) |
| C(17)-C(18) | 1.368(5) |
| C(17)-H(17A) | 0.9300 |
| C(18)-C(19) | 1.354(6) |
| C(18)-H(18A) | 0.9300 |
| C(19)-C(20) | 1.352(5) |
| C(20)-C(21) | 1.367(5) |
| C(20)-H(20A) | 0.9300 |
| C(21)-H(21A) | 0.9300 |
| C(6)-S(1)-C(7) | 101.31(14) |
| C(16)-S(2)-C(7) | 101.33(13) |
| C(11)-O(2)-C(15) | 118.2(2) |
| C(8)-N(1)-C(9) | 112.2(2) |
| C(8)-N(1)-H(1A) | 123.9 |
| C(9)-N(1)-H(1A) | 123.9 |
| C(6)-C(1)-C(2) | 119.8(5) |
| C(6)-C(1)-H(1B) | 120.1 |
| C(2)-C(1)-H(1B) | 120.1 |
| C(3)-C(2)-C(1) | 120.8(5) |
| C(3)-C(2)-H(2A) | 119.6 |
| C(1)-C(2)-H(2A) | 119.6 |
| C(4)-C(3)-C(2) | 118.7(5) |
| C(4)-C(3)-H(3A) | 120.7 |
| C(2)-C(3)-H(3A) | 120.7 |
| C(3)-C(4)-C(5) | 121.9(5) |
| C(3)-C(4)-H(4A) | 119.0 |
| C(5)-C(4)-H(4A) | 119.0 |
| C(6)-C(5)-C(4) | 119.2(4) |
| C(6)-C(5)-H(5A) | 120.4 |
| C(4)-C(5)-H(5A) | 120.4 |
| C(1)-C(6)-C(5) | 119.6(4) |
| C(1)-C(6)-S(1) | 120.7(3) |
| C(5)-C(6)-S(1) | 119.5(3) |
| C(14)-C(7)-C(8) | 103.3(2) |
| C(14)-C(7)-S(1) | 116.7(2) |
| C(8)-C(7)-S(1) | 112.0(2) |
| C(14)-C(7)-S(2) | 114.6(2) |
| C(8)-C(7)-S(2) | 108.8(2) |
| S(1)-C(7)-S(2) | 101.53(13) |
| O(1)-C(8)-N(1) | 126.8(3) |

| | |
|---|---|
| O(1)-C(8)-C(7) | 126.5(3) |
| N(1)-C(8)-C(7) | 106.7(2) |
| C(10)-C(9)-C(14) | 123.6(2) |
| C(10)-C(9)-N(1) | 126.8(3) |
| C(14)-C(9)-N(1) | 109.6(2) |
| C(9)-C(10)-C(11) | 116.6(3) |
| C(9)-C(10)-H(10A) | 121.7 |
| C(11)-C(10)-H(10A) | 121.7 |
| O(2)-C(11)-C(12) | 114.8(2) |
| O(2)-C(11)-C(10) | 124.5(3) |
| C(12)-C(11)-C(10) | 120.7(3) |
| C(13)-C(12)-C(11) | 120.8(3) |
| C(13)-C(12)-H(12A) | 119.6 |
| C(11)-C(12)-H(12A) | 119.6 |
| C(14)-C(13)-C(12) | 119.2(3) |
| C(14)-C(13)-H(13A) | 120.4 |
| C(12)-C(13)-H(13A) | 120.4 |
| C(13)-C(14)-C(9) | 119.0(3) |
| C(13)-C(14)-C(7) | 132.8(3) |
| C(9)-C(14)-C(7) | 108.1(2) |
| O(2)-C(15)-H(15A) | 109.5 |
| O(2)-C(15)-H(15B) | 109.5 |
| H(15A)-C(15)-H(15B) | 109.5 |
| O(2)-C(15)-H(15C) | 109.5 |
| H(15A)-C(15)-H(15C) | 109.5 |
| H(15B)-C(15)-H(15C) | 109.5 |
| C(17)-C(16)-C(21) | 117.4(3) |
| C(17)-C(16)-S(2) | 121.8(3) |
| C(21)-C(16)-S(2) | 120.7(3) |
| C(16)-C(17)-C(18) | 121.6(4) |
| C(16)-C(17)-H(17A) | 119.2 |
| C(18)-C(17)-H(17A) | 119.2 |
| C(19)-C(18)-C(17) | 120.0(4) |
| C(19)-C(18)-H(18A) | 120.0 |
| C(17)-C(18)-H(18A) | 120.0 |
| C(20)-C(19)-C(18) | 119.4(4) |
| C(20)-C(19)-Cl(1) | 120.3(4) |
| C(18)-C(19)-Cl(1) | 120.3(4) |
| C(19)-C(20)-C(21) | 120.5(4) |
| C(19)-C(20)-H(20A) | 119.8 |
| C(21)-C(20)-H(20A) | 119.8 |
| C(20)-C(21)-C(16) | 121.0(4) |

| | |
|---|---|
| C(20)-C(21)-H(21A) | 119.5 |
| C(16)-C(21)-H(21A) | 119.5 |

Symmetry transformations used to generate equivalent atoms:

Table 4. Anisotropic displacement parameters (A^2 x 10^3) for z.
The anisotropic displacement factor exponent takes the form:
-2 pi^2 [ h^2 a*^2 U11 + ... + 2 h k a* b* U12 ]

| | U11 | U22 | U33 | U23 | U13 | U12 |
|---|---|---|---|---|---|---|
| S(1) | 40(1) | 73(1) | 59(1) | 4(1) | 12(1) | 3(1) |
| S(2) | 35(1) | 68(1) | 61(1) | 3(1) | -3(1) | -3(1) |
| Cl(1) | 88(1) | 152(1) | 59(1) | -20(1) | 14(1) | -37(1) |
| O(1) | 36(1) | 44(1) | 100(2) | 18(1) | 0(1) | 0(1) |
| O(2) | 42(1) | 45(1) | 92(2) | 8(1) | 1(1) | -7(1) |
| N(1) | 28(1) | 37(2) | 74(2) | 8(1) | 2(1) | 4(1) |
| C(1) | 99(3) | 81(3) | 62(3) | 13(2) | -5(2) | 7(3) |
| C(2) | 108(4) | 142(5) | 61(3) | 27(3) | -11(3) | 15(4) |
| C(3) | 95(4) | 166(6) | 65(3) | 18(4) | -1(3) | -27(4) |
| C(4) | 102(4) | 129(5) | 71(3) | -16(3) | 8(3) | -45(4) |
| C(5) | 68(2) | 76(3) | 74(3) | 3(2) | 13(2) | -7(2) |
| C(6) | 49(2) | 65(2) | 54(2) | 6(2) | 14(2) | 0(2) |
| C(7) | 28(1) | 44(2) | 52(2) | 4(1) | 3(1) | 3(1) |
| C(8) | 35(2) | 40(2) | 57(2) | 5(2) | 1(2) | 0(1) |
| C(9) | 34(2) | 34(2) | 40(2) | 2(1) | -3(1) | 1(1) |
| C(10) | 30(2) | 46(2) | 52(2) | 4(1) | 1(1) | 2(1) |
| C(11) | 38(2) | 42(2) | 48(2) | 1(1) | -3(2) | -2(2) |
| C(12) | 48(2) | 34(2) | 69(2) | 6(2) | 0(2) | 2(2) |
| C(13) | 38(2) | 41(2) | 66(2) | 5(2) | 2(2) | 9(2) |
| C(14) | 33(2) | 42(2) | 46(2) | 3(2) | 1(1) | 3(1) |
| C(15) | 40(2) | 64(2) | 87(3) | 2(2) | 3(2) | -8(2) |
| C(16) | 48(2) | 50(2) | 51(2) | -1(2) | -10(2) | -5(2) |
| C(17) | 119(3) | 57(3) | 73(3) | 5(2) | 26(3) | 6(3) |
| C(18) | 136(4) | 71(3) | 80(3) | -10(3) | 30(3) | 14(3) |
| C(19) | 63(2) | 95(3) | 47(2) | -10(2) | -2(2) | -19(2) |
| C(20) | 76(3) | 75(3) | 66(3) | 16(2) | -1(2) | -14(2) |
| C(21) | 73(3) | 62(2) | 70(2) | 7(2) | 1(2) | 7(2) |

Table 5. Hydrogen coordinates ( x 10^4) and isotropic displacement parameters (A^2 x 10^3) for z.

| | x | y | z | U(eq) |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| H(1A) | -2159 | 1950 | 170 | 55 |
| H(1B) | 396 | 1900 | -1509 | 97 |
| H(2A) | -1276 | 1562 | -2479 | 125 |
| H(3A) | -1617 | -148 | -2913 | 130 |
| H(4A) | -386 | -1504 | -2337 | 121 |
| H(5A) | 1270 | -1201 | -1355 | 87 |
| H(10A) | -3772 | 205 | 497 | 51 |
| H(12A) | -1098 | -2381 | 744 | 61 |
| H(13A) | 1063 | -1393 | 477 | 58 |
| H(15A) | -6048 | -2011 | 907 | 95 |
| H(15B) | -5554 | -1179 | 308 | 95 |
| H(15C) | -5429 | -899 | 1153 | 95 |
| H(17A) | 668 | 2621 | 1667 | 100 |
| H(18A) | -814 | 2638 | 2714 | 114 |
| H(20A) | 208 | -366 | 3076 | 87 |
| H(21A) | 1666 | -396 | 2021 | 82 |

Table 6. Torsion angles [deg] for z.

| | |
|---|---|
| C(6)-C(1)-C(2)-C(3) | -1.5(7) |
| C(1)-C(2)-C(3)-C(4) | 1.6(8) |
| C(2)-C(3)-C(4)-C(5) | -1.1(7) |
| C(3)-C(4)-C(5)-C(6) | 0.5(6) |
| C(2)-C(1)-C(6)-C(5) | 0.9(6) |
| C(2)-C(1)-C(6)-S(1) | 176.3(3) |
| C(4)-C(5)-C(6)-C(1) | -0.4(5) |
| C(4)-C(5)-C(6)-S(1) | -175.9(3) |
| C(7)-S(1)-C(6)-C(1) | 80.0(3) |
| C(7)-S(1)-C(6)-C(5) | -104.6(3) |
| C(6)-S(1)-C(7)-C(14) | 54.5(2) |
| C(6)-S(1)-C(7)-C(8) | -64.2(2) |
| C(6)-S(1)-C(7)-S(2) | 179.91(16) |
| C(16)-S(2)-C(7)-C(14) | -44.9(2) |
| C(16)-S(2)-C(7)-C(8) | 70.2(2) |
| C(16)-S(2)-C(7)-S(1) | -171.60(15) |
| C(9)-N(1)-C(8)-O(1) | -179.9(3) |
| C(9)-N(1)-C(8)-C(7) | 0.0(4) |
| C(14)-C(7)-C(8)-O(1) | -179.8(3) |
| S(1)-C(7)-C(8)-O(1) | -53.4(4) |
| S(2)-C(7)-C(8)-O(1) | 58.0(4) |
| C(14)-C(7)-C(8)-N(1) | 0.4(3) |

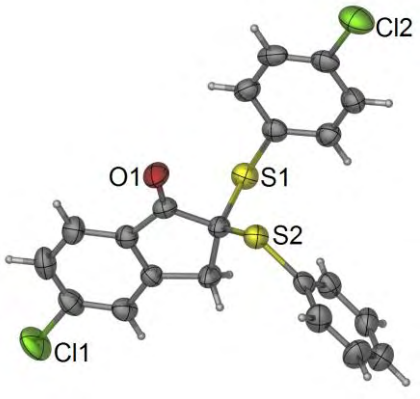
| | |
|---|---|
| S(1)-C(7)-C(8)-N(1) | 126.8(2) |
| S(2)-C(7)-C(8)-N(1) | -121.8(2) |
| C(8)-N(1)-C(9)-C(10) | 179.4(3) |
| C(8)-N(1)-C(9)-C(14) | -0.4(4) |
| C(14)-C(9)-C(10)-C(11) | 0.5(4) |
| N(1)-C(9)-C(10)-C(11) | -179.2(3) |
| C(15)-O(2)-C(11)-C(12) | -177.1(3) |
| C(15)-O(2)-C(11)-C(10) | 1.4(4) |
| C(9)-C(10)-C(11)-O(2) | -179.5(3) |
| C(9)-C(10)-C(11)-C(12) | -1.2(4) |
| O(2)-C(11)-C(12)-C(13) | 179.1(3) |
| C(10)-C(11)-C(12)-C(13) | 0.6(5) |
| C(11)-C(12)-C(13)-C(14) | 0.7(5) |
| C(12)-C(13)-C(14)-C(9) | -1.3(5) |
| C(12)-C(13)-C(14)-C(7) | 178.5(3) |
| C(10)-C(9)-C(14)-C(13) | 0.7(5) |
| N(1)-C(9)-C(14)-C(13) | -179.5(3) |
| C(10)-C(9)-C(14)-C(7) | -179.2(3) |
| N(1)-C(9)-C(14)-C(7) | 0.6(3) |
| C(8)-C(7)-C(14)-C(13) | 179.5(3) |
| S(1)-C(7)-C(14)-C(13) | 56.2(4) |
| S(2)-C(7)-C(14)-C(13) | -62.3(4) |
| C(8)-C(7)-C(14)-C(9) | -0.6(3) |
| S(1)-C(7)-C(14)-C(9) | -124.0(2) |
| S(2)-C(7)-C(14)-C(9) | 117.6(2) |
| C(7)-S(2)-C(16)-C(17) | -86.5(3) |
| C(7)-S(2)-C(16)-C(21) | 98.2(3) |
| C(21)-C(16)-C(17)-C(18) | -1.4(6) |
| S(2)-C(16)-C(17)-C(18) | -176.9(4) |
| C(16)-C(17)-C(18)-C(19) | 2.3(7) |
| C(17)-C(18)-C(19)-C(20) | -2.7(7) |
| C(17)-C(18)-C(19)-Cl(1) | 177.6(4) |
| C(18)-C(19)-C(20)-C(21) | 2.3(6) |
| Cl(1)-C(19)-C(20)-C(21) | -178.1(3) |
| C(19)-C(20)-C(21)-C(16) | -1.4(6) |
| C(17)-C(16)-C(21)-C(20) | 1.0(5) |
| S(2)-C(16)-C(21)-C(20) | 176.5(3) |

Symmetry transformations used to generate equivalent atoms:

Table 7. Hydrogen bonds for z [A and deg.].

| D-H...A | d(D-H) | d(H...A) | d(D...A) | <(DHA) |
|---|---|---|---|---|

**5) Single-Crystal X-ray Crystallography of 6f.**[14]




Data intensity of **6f** was collected using a Bruker SMART APEX II (Mo radiation) at 296 K in a nitrogen stream. Data collection and reduction were done by using the Bruker ApexII software package. The structures were solved by direct methods and refined by full-matrix least-squares on $F^2$ with anisotropic displacement parameters for non-H atoms using SHELX-97. Hydrogen atoms were added at their geometrically idea positions and refined isotropically. Crystal data for **6f**: $C_{21}H_{14}Cl_2OS_2$, $T$ = 296(2) K, Triclinic, space group P1, a = 6.8482(4) Å , b = 7.9264(4) Å , c = 8.7986(5) Å , alpha = 92.069(2) deg, beta = 99.774(2) deg, gamma = 96.704(2) deg. $V$ = 466.69(4) Å $^3$. Z = 1, $d_{calc}$ = 1.485 mg/m$^3$. Total number of reflections 5443 [R(int) = 0.0167], $R_1$ = 0.0306 (I > 2σ(I)), $wR_2$ = 0.0769 (all data), GOF = 1.033, and 235 parameters.

Table 1. Crystal data and structure refinement for z.

| | |
|---|---|
| Identification code | z |
| Empirical formula | C21 H14 Cl2 O S2 |
| Formula weight | 417.34 |
| Temperature | 296(2) K |
| Wavelength | 0.71073 A |
| Crystal system, space group | Triclinic, P1 |
| Unit cell dimensions | a = 6.8482(4) A alpha = 92.069(2) deg. |
| | b = 7.9264(4) A beta = 99.774(2) deg. |
| | c = 8.7986(5) A gamma = 96.704(2) deg. |
| Volume | 466.69(4) A^3 |
| Z, Calculated density | 1, 1.485 Mg/m^3 |

[14] Supplementary crystallographic data have been deposited at the Cambridge Crystallographic Data Center. (CCDC 1413670).

| | |
|---|---|
| Absorption coefficient | 0.579 mm^-1 |
| F(000) | 214 |
| Crystal size | 0.32 x 0.23 x 0.15 mm |
| Theta range for data collection | 2.35 to 25.00 deg. |
| Limiting indices | -8<=h<=7, -9<=k<=9, -10<=l<=10 |
| Reflections collected / unique | 5443 / 2607 [R(int) = 0.0167] |
| Completeness to theta = 25.00 | 99.1 % |
| Absorption correction | Semi-empirical from equivalents |
| Max. and min. transmission | 0.9182 and 0.8364 |
| Refinement method | Full-matrix least-squares on F^2 |
| Data / restraints / parameters | 2607 / 3 / 235 |
| Goodness-of-fit on F^2 | 1.033 |
| Final R indices [I>2sigma(I)] | R1 = 0.0306, wR2 = 0.0758 |
| R indices (all data) | R1 = 0.0319, wR2 = 0.0769 |
| Absolute structure parameter | 0.03(6) |
| Largest diff. peak and hole | 0.417 and -0.190 e.A^-3 |

Table 2. Atomic coordinates ( x 10^4) and equivalent isotropic displacement parameters (A^2 x 10^3) for z.
U(eq) is defined as one third of the trace of the orthogonalized Uij tensor.

| | x | y | z | U(eq) |
|---|---|---|---|---|
| S(1) | 10503(1) | 4483(1) | 4796(1) | 47(1) |
| S(2) | 9767(1) | 2596(1) | 7738(1) | 42(1) |
| O(1) | 6610(3) | 1598(3) | 4900(2) | 52(1) |
| Cl(1) | 12122(2) | -3358(1) | 1263(1) | 79(1) |
| Cl(2) | 5459(2) | 9077(1) | 8110(1) | 75(1) |
| C(1) | 8992(4) | 164(4) | 3788(3) | 39(1) |
| C(2) | 7890(5) | -934(4) | 2619(3) | 48(1) |
| C(3) | 8857(6) | -2021(4) | 1836(4) | 56(1) |
| C(4) | 10911(5) | -1983(4) | 2259(3) | 49(1) |
| C(5) | 12042(5) | -893(4) | 3428(3) | 43(1) |
| C(6) | 11041(4) | 185(4) | 4180(3) | 38(1) |
| C(7) | 11931(4) | 1463(4) | 5498(3) | 46(1) |
| C(8) | 10185(4) | 2430(4) | 5759(3) | 38(1) |
| C(9) | 8306(4) | 1399(4) | 4812(3) | 38(1) |

| | | | | |
|---|---|---|---|---|
| C(10) | 12192(5) | 2919(4) | 8868(3) | 40(1) |
| C(11) | 13834(5) | 3870(4) | 8444(3) | 46(1) |
| C(12) | 15645(5) | 4074(4) | 9400(4) | 53(1) |
| C(13) | 15874(6) | 3360(5) | 10814(4) | 62(1) |
| C(14) | 14236(7) | 2448(5) | 11259(4) | 66(1) |
| C(15) | 12433(6) | 2203(4) | 10288(3) | 53(1) |
| C(16) | 9021(5) | 5784(4) | 5671(3) | 41(1) |
| C(17) | 9952(5) | 6882(4) | 6932(3) | 46(1) |
| C(18) | 8860(5) | 7903(4) | 7646(4) | 51(1) |
| C(19) | 6842(5) | 7844(4) | 7127(4) | 48(1) |
| C(20) | 5909(5) | 6807(4) | 5868(4) | 51(1) |
| C(21) | 6993(5) | 5770(4) | 5132(4) | 48(1) |

Table 3. Bond lengths [A] and angles [deg] for z.

| | |
|---|---|
| S(1)-C(16) | 1.771(3) |
| S(1)-C(8) | 1.869(3) |
| S(2)-C(10) | 1.770(3) |
| S(2)-C(8) | 1.814(3) |
| O(1)-C(9) | 1.205(4) |
| Cl(1)-C(4) | 1.741(3) |
| Cl(2)-C(19) | 1.742(4) |
| C(1)-C(2) | 1.380(4) |
| C(1)-C(6) | 1.385(4) |
| C(1)-C(9) | 1.476(4) |
| C(2)-C(3) | 1.379(5) |
| C(2)-H(2A) | 0.9300 |
| C(3)-C(4) | 1.389(5) |
| C(3)-H(3A) | 0.9300 |
| C(4)-C(5) | 1.383(4) |
| C(5)-C(6) | 1.374(4) |
| C(5)-H(5A) | 0.9300 |
| C(6)-C(7) | 1.508(4) |
| C(7)-C(8) | 1.538(4) |
| C(7)-H(7A) | 0.9700 |
| C(7)-H(7B) | 0.9700 |
| C(8)-C(9) | 1.536(4) |
| C(10)-C(15) | 1.383(4) |
| C(10)-C(11) | 1.392(4) |
| C(11)-C(12) | 1.364(5) |
| C(11)-H(11A) | 0.9300 |
| C(12)-C(13) | 1.378(5) |

| | |
|---|---|
| C(12)-H(12A) | 0.9300 |
| C(13)-C(14) | 1.384(5) |
| C(13)-H(13A) | 0.9300 |
| C(14)-C(15) | 1.366(5) |
| C(14)-H(14A) | 0.9300 |
| C(15)-H(15A) | 0.9300 |
| C(16)-C(21) | 1.388(5) |
| C(16)-C(17) | 1.399(4) |
| C(17)-C(18) | 1.369(5) |
| C(17)-H(17A) | 0.9300 |
| C(18)-C(19) | 1.375(5) |
| C(18)-H(18A) | 0.9300 |
| C(19)-C(20) | 1.372(5) |
| C(20)-C(21) | 1.383(5) |
| C(20)-H(20A) | 0.9300 |
| C(21)-H(21A) | 0.9300 |
| C(16)-S(1)-C(8) | 103.69(13) |
| C(10)-S(2)-C(8) | 104.59(13) |
| C(2)-C(1)-C(6) | 121.0(3) |
| C(2)-C(1)-C(9) | 129.2(3) |
| C(6)-C(1)-C(9) | 109.8(2) |
| C(3)-C(2)-C(1) | 119.0(3) |
| C(3)-C(2)-H(2A) | 120.5 |
| C(1)-C(2)-H(2A) | 120.5 |
| C(2)-C(3)-C(4) | 118.8(3) |
| C(2)-C(3)-H(3A) | 120.6 |
| C(4)-C(3)-H(3A) | 120.6 |
| C(5)-C(4)-C(3) | 123.0(3) |
| C(5)-C(4)-Cl(1) | 118.5(3) |
| C(3)-C(4)-Cl(1) | 118.5(2) |
| C(6)-C(5)-C(4) | 116.9(3) |
| C(6)-C(5)-H(5A) | 121.5 |
| C(4)-C(5)-H(5A) | 121.5 |
| C(5)-C(6)-C(1) | 121.2(3) |
| C(5)-C(6)-C(7) | 126.8(3) |
| C(1)-C(6)-C(7) | 111.9(2) |
| C(6)-C(7)-C(8) | 104.3(2) |
| C(6)-C(7)-H(7A) | 110.9 |
| C(8)-C(7)-H(7A) | 110.9 |
| C(6)-C(7)-H(7B) | 110.9 |
| C(8)-C(7)-H(7B) | 110.9 |
| H(7A)-C(7)-H(7B) | 108.9 |

| | |
|---|---|
| C(9)-C(8)-C(7) | 105.6(2) |
| C(9)-C(8)-S(2) | 106.72(19) |
| C(7)-C(8)-S(2) | 115.5(2) |
| C(9)-C(8)-S(1) | 105.54(19) |
| C(7)-C(8)-S(1) | 106.8(2) |
| S(2)-C(8)-S(1) | 115.80(15) |
| O(1)-C(9)-C(1) | 127.7(3) |
| O(1)-C(9)-C(8) | 125.5(3) |
| C(1)-C(9)-C(8) | 106.8(2) |
| C(15)-C(10)-C(11) | 118.5(3) |
| C(15)-C(10)-S(2) | 116.8(2) |
| C(11)-C(10)-S(2) | 124.7(2) |
| C(12)-C(11)-C(10) | 120.7(3) |
| C(12)-C(11)-H(11A) | 119.6 |
| C(10)-C(11)-H(11A) | 119.6 |
| C(11)-C(12)-C(13) | 120.5(3) |
| C(11)-C(12)-H(12A) | 119.7 |
| C(13)-C(12)-H(12A) | 119.7 |
| C(12)-C(13)-C(14) | 119.1(3) |
| C(12)-C(13)-H(13A) | 120.5 |
| C(14)-C(13)-H(13A) | 120.5 |
| C(15)-C(14)-C(13) | 120.5(3) |
| C(15)-C(14)-H(14A) | 119.7 |
| C(13)-C(14)-H(14A) | 119.7 |
| C(14)-C(15)-C(10) | 120.6(3) |
| C(14)-C(15)-H(15A) | 119.7 |
| C(10)-C(15)-H(15A) | 119.7 |
| C(21)-C(16)-C(17) | 119.3(3) |
| C(21)-C(16)-S(1) | 122.4(2) |
| C(17)-C(16)-S(1) | 118.3(2) |
| C(18)-C(17)-C(16) | 120.2(3) |
| C(18)-C(17)-H(17A) | 119.9 |
| C(16)-C(17)-H(17A) | 119.9 |
| C(17)-C(18)-C(19) | 119.9(3) |
| C(17)-C(18)-H(18A) | 120.0 |
| C(19)-C(18)-H(18A) | 120.0 |
| C(20)-C(19)-C(18) | 120.8(3) |
| C(20)-C(19)-Cl(2) | 120.0(3) |
| C(18)-C(19)-Cl(2) | 119.2(3) |
| C(19)-C(20)-C(21) | 119.9(3) |
| C(19)-C(20)-H(20A) | 120.0 |
| C(21)-C(20)-H(20A) | 120.0 |

| | |
|---|---|
| C(20)-C(21)-C(16) | 119.8(3) |
| C(20)-C(21)-H(21A) | 120.1 |
| C(16)-C(21)-H(21A) | 120.1 |

Symmetry transformations used to generate equivalent atoms:

Table 4. Anisotropic displacement parameters (A^2 x 10^3) for z.

The anisotropic displacement factor exponent takes the form:

-2 pi^2 [ h^2 a*^2 U11 + ... + 2 h k a* b* U12 ]

| | U11 | U22 | U33 | U23 | U13 | U12 |
|---|---|---|---|---|---|---|
| S(1) | 49(1) | 50(1) | 45(1) | 8(1) | 16(1) | 5(1) |
| S(2) | 42(1) | 44(1) | 41(1) | 4(1) | 11(1) | 7(1) |
| O(1) | 34(1) | 60(1) | 59(1) | -6(1) | 3(1) | 10(1) |
| Cl(1) | 105(1) | 70(1) | 70(1) | -19(1) | 28(1) | 30(1) |
| Cl(2) | 67(1) | 68(1) | 98(1) | 7(1) | 27(1) | 26(1) |
| C(1) | 39(2) | 39(2) | 40(1) | 3(1) | 7(1) | 4(1) |
| C(2) | 42(2) | 50(2) | 48(2) | -3(1) | 6(1) | -5(1) |
| C(3) | 69(3) | 48(2) | 46(2) | -10(1) | 11(2) | -7(2) |
| C(4) | 65(2) | 42(2) | 45(2) | 0(1) | 20(2) | 11(2) |
| C(5) | 47(2) | 46(2) | 39(1) | 5(1) | 12(1) | 13(1) |
| C(6) | 42(2) | 37(2) | 35(1) | 3(1) | 6(1) | 7(1) |
| C(7) | 37(2) | 53(2) | 45(2) | -10(1) | 1(1) | 13(1) |
| C(8) | 36(2) | 41(2) | 37(1) | -1(1) | 4(1) | 9(1) |
| C(9) | 34(2) | 42(2) | 40(1) | 7(1) | 6(1) | 7(1) |
| C(10) | 49(2) | 35(2) | 37(1) | -2(1) | 8(1) | 8(1) |
| C(11) | 55(2) | 44(2) | 37(1) | 2(1) | 10(1) | 3(2) |
| C(12) | 47(2) | 54(2) | 53(2) | -9(2) | 6(2) | 0(2) |
| C(13) | 58(2) | 62(2) | 60(2) | -4(2) | -8(2) | 6(2) |
| C(14) | 81(3) | 65(2) | 45(2) | 12(2) | -8(2) | 7(2) |
| C(15) | 63(2) | 51(2) | 44(2) | 8(1) | 9(2) | 0(2) |
| C(16) | 44(2) | 36(2) | 46(2) | 12(1) | 12(1) | 3(1) |
| C(17) | 39(2) | 43(2) | 54(2) | 7(1) | 4(1) | 3(1) |
| C(18) | 51(2) | 40(2) | 60(2) | -1(1) | 6(2) | 2(2) |
| C(19) | 48(2) | 39(2) | 62(2) | 16(1) | 12(2) | 9(1) |
| C(20) | 36(2) | 48(2) | 68(2) | 23(2) | 5(2) | 8(1) |
| C(21) | 43(2) | 49(2) | 49(2) | 12(1) | -1(1) | 6(2) |

Table 5. Hydrogen coordinates ( x 10^4) and isotropic displacement parameters (A^2 x 10^3) for z.

| | x | y | z | U(eq) |
|---|---|---|---|---|
| H(2A) | 6514 | -941 | 2362 | 58 |
| H(3A) | 8148 | -2767 | 1038 | 67 |
| H(5A) | 13416 | -891 | 3693 | 51 |
| H(7A) | 13013 | 2230 | 5227 | 55 |
| H(7B) | 12434 | 896 | 6417 | 55 |
| H(11A) | 13695 | 4373 | 7499 | 55 |
| H(12A) | 16733 | 4700 | 9095 | 63 |
| H(13A) | 17113 | 3489 | 11460 | 75 |
| H(14A) | 14363 | 1997 | 12227 | 79 |
| H(15A) | 11358 | 1550 | 10585 | 63 |
| H(17A) | 11316 | 6919 | 7286 | 55 |
| H(18A) | 9483 | 8636 | 8482 | 61 |
| H(20A) | 4550 | 6801 | 5510 | 61 |
| H(21A) | 6365 | 5066 | 4278 | 58 |

Table 6. Torsion angles [deg] for z.

| | |
|---|---|
| C(6)-C(1)-C(2)-C(3) | 0.0(5) |
| C(9)-C(1)-C(2)-C(3) | -178.1(3) |
| C(1)-C(2)-C(3)-C(4) | 0.5(5) |
| C(2)-C(3)-C(4)-C(5) | -0.4(5) |
| C(2)-C(3)-C(4)-Cl(1) | -179.9(2) |
| C(3)-C(4)-C(5)-C(6) | -0.1(4) |
| Cl(1)-C(4)-C(5)-C(6) | 179.4(2) |
| C(4)-C(5)-C(6)-C(1) | 0.6(4) |
| C(4)-C(5)-C(6)-C(7) | 179.0(3) |
| C(2)-C(1)-C(6)-C(5) | -0.6(4) |
| C(9)-C(1)-C(6)-C(5) | 177.9(3) |
| C(2)-C(1)-C(6)-C(7) | -179.2(3) |
| C(9)-C(1)-C(6)-C(7) | -0.8(3) |
| C(5)-C(6)-C(7)-C(8) | 174.2(3) |
| C(1)-C(6)-C(7)-C(8) | -7.2(3) |
| C(6)-C(7)-C(8)-C(9) | 11.8(3) |
| C(6)-C(7)-C(8)-S(2) | 129.4(2) |
| C(6)-C(7)-C(8)-S(1) | -100.2(2) |
| C(10)-S(2)-C(8)-C(9) | 155.4(2) |
| C(10)-S(2)-C(8)-C(7) | 38.4(2) |
| C(10)-S(2)-C(8)-S(1) | -87.44(18) |

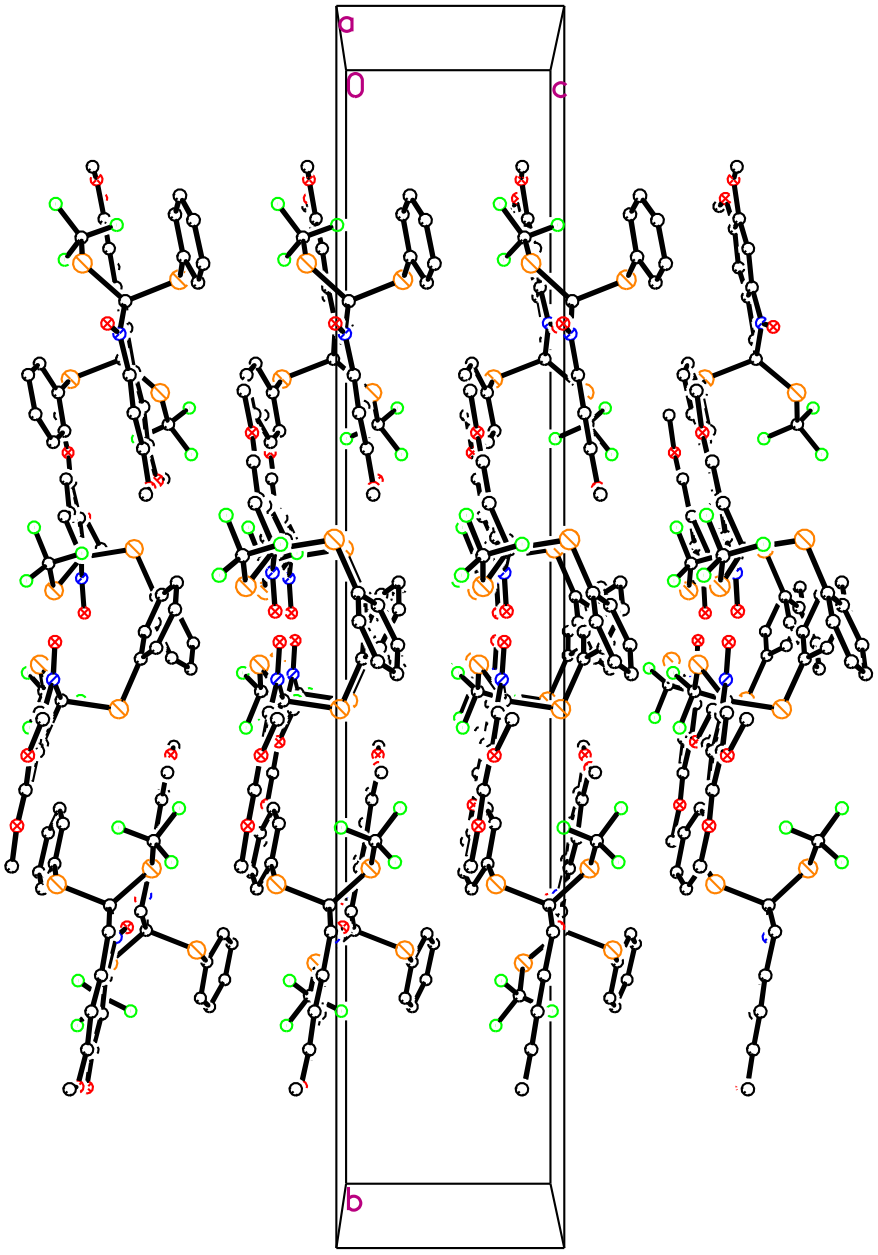
| | |
|---|---|
| C(16)-S(1)-C(8)-C(9) | 87.0(2) |
| C(16)-S(1)-C(8)-C(7) | -160.96(19) |
| C(16)-S(1)-C(8)-S(2) | -30.8(2) |
| C(2)-C(1)-C(9)-O(1) | 6.1(5) |
| C(6)-C(1)-C(9)-O(1) | -172.2(3) |
| C(2)-C(1)-C(9)-C(8) | -173.2(3) |
| C(6)-C(1)-C(9)-C(8) | 8.5(3) |
| C(7)-C(8)-C(9)-O(1) | 168.1(3) |
| S(2)-C(8)-C(9)-O(1) | 44.7(4) |
| S(1)-C(8)-C(9)-O(1) | -79.1(3) |
| C(7)-C(8)-C(9)-C(1) | -12.6(3) |
| S(2)-C(8)-C(9)-C(1) | -136.0(2) |
| S(1)-C(8)-C(9)-C(1) | 100.3(2) |
| C(8)-S(2)-C(10)-C(15) | -145.6(2) |
| C(8)-S(2)-C(10)-C(11) | 36.2(3) |
| C(15)-C(10)-C(11)-C(12) | 0.8(5) |
| S(2)-C(10)-C(11)-C(12) | 179.0(2) |
| C(10)-C(11)-C(12)-C(13) | -0.9(5) |
| C(11)-C(12)-C(13)-C(14) | -0.7(6) |
| C(12)-C(13)-C(14)-C(15) | 2.4(6) |
| C(13)-C(14)-C(15)-C(10) | -2.6(6) |
| C(11)-C(10)-C(15)-C(14) | 0.9(5) |
| S(2)-C(10)-C(15)-C(14) | -177.4(3) |
| C(8)-S(1)-C(16)-C(21) | -86.3(3) |
| C(8)-S(1)-C(16)-C(17) | 94.9(2) |
| C(21)-C(16)-C(17)-C(18) | 1.5(4) |
| S(1)-C(16)-C(17)-C(18) | -179.7(2) |
| C(16)-C(17)-C(18)-C(19) | 0.3(5) |
| C(17)-C(18)-C(19)-C(20) | -1.9(5) |
| C(17)-C(18)-C(19)-Cl(2) | 176.9(2) |
| C(18)-C(19)-C(20)-C(21) | 1.8(5) |
| Cl(2)-C(19)-C(20)-C(21) | -177.1(2) |
| C(19)-C(20)-C(21)-C(16) | 0.0(5) |
| C(17)-C(16)-C(21)-C(20) | -1.6(4) |
| S(1)-C(16)-C(21)-C(20) | 179.6(2) |

Symmetry transformations used to generate equivalent atoms:

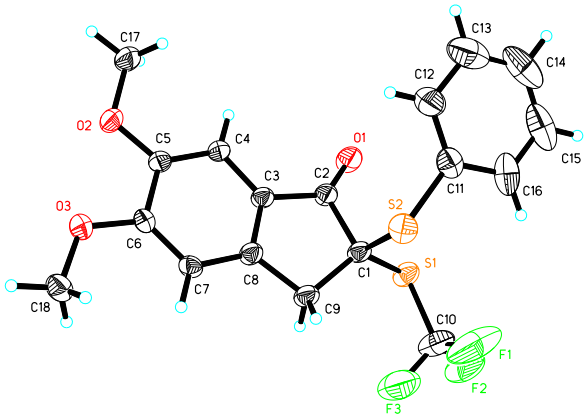
Table 7. Hydrogen bonds for z [A and deg.].

| D-H...A | d(D-H) | d(H...A) | d(D...A) | <(DHA) |
|---|---|---|---|---|

## 6) Single-Crystal X-ray Crystallography of 8k.[15]




[15] Supplementary crystallographic data have been deposited at the Cambridge Crystallographic Data Center. (CCDC 1413672).




Data intensity of **8k** was collected using a 'Bruker APEX-II CCD' diffractometer. Single crystals of $C_{18}H_{15}F_3O_3S_2$ [dm15546] is shown above. A suitable crystal was selected and analyzed on a 'Bruker APEX-II CCD' diffractometer. The crystal was kept at 296.15 K during data collection. Using Olex2, the structure was solved with the ShelXS structure solution program using Direct Methods and refined with the XL refinement package using Least Squares minimization. Crystal Data for $C_{18}H_{15}F_3O_3S_2$ (*M* =400.42 g/mol): Orthorhombic, space group P 21 21 2, *a* = 13.1691(14) Å, *b* = 38.663(4) Å, *c* = 7.1029(8) Å, *V* = 3616.5(7) Å$^3$, *Z* = 8, *T* = 296.15 K, μ(MoKα) = 0.339 mm$^{-1}$, *Dcalc* = 1.471 g/cm$^3$, 35999 reflections measured (1.634 ≤ 2Θ ≤30.474), 10915 unique ($R_{int}$ = 0.0451) which were used in all calculations. The final $R_1$ was 0.0672 (I > 2σ(I)) and $wR_2$ was 0.2020 (all data).

Table 1. Crystal data and structure refinement for DM15546.

Identification code dm15546

Empirical formula C18 H15 F3 O3 S2

Formula weight 400.42

Temperature 296.15 K

Wavelength 0.71073 Å

Crystal system Orthorhombic

Space group P 21 21 2

Unit cell dimensions a = 13.1691(14) Å = 90°.

b = 38.663(4) Å = 90°.

c = 7.1029(8) Å = 90°.

Volume 3616.5(7) Å 3

Z 8

Density (calculated) 1.471 Mg/m3

Absorption coefficient 0.339 mm-1

F(000) 1648

Crystal size ? x ? x ? mm3

Theta range for data collection 1.634 to 30.474°.

Index ranges -18<=h<=18, -54<=k<=49, -9<=l<=10

Reflections collected 35999

Independent reflections 10915 [R(int) = 0.0451]

Completeness to theta = 25.242°99.5 %

Absorption correction Semi-empirical from equivalents

Max. and min. transmission 0.7461 and 0.6495

Refinement method Full-matrix least-squares on F2

Data / restraints / parameters 10915 / 90 / 474

Goodness-of-fit on F2 1.143

Final R indices [I>2sigma(I)] R1 = 0.0672, wR2 = 0.1789

R indices (all data) R1 = 0.1130, wR2 = 0.2020

Absolute structure parameter 0.02(12)

Extinction coefficient n/a

Largest diff. peak and hole 0.734 and -0.536 e.Å -3

Table 2. Atomic coordinates ( x 104) and equivalent isotropic displacement parameters (Å 2x 103) for DM15546. U(eq) is defined as one third of the trace of the orthogonalized Uij tensor.

| | x | y | z | U(eq) |
|---|---|---|---|---|
| S(1) | 8319(1) | 316(1) | 3661(2) | 56(1) |
| S(2) | 7689(1) | 682(1) | -29(2) | 59(1) |
| F(1) | 9843(5) | 620(2) | 2075(12) | 177(3) |
| F(2) | 10154(3) | 392(1) | 4596(10) | 118(2) |
| F(3) | 9431(4) | 852(1) | 4382(13) | 144(2) |
| O(1) | 6270(3) | 124(1) | 2591(7) | 62(1) |
| O(2) | 3045(2) | 1011(1) | 3145(6) | 54(1) |

O(3) 3966(3) 1583(1) 3799(6) 54(1)
C(1) 7452(3) 608(1) 2518(8) 45(1)
C(2) 6399(4) 431(1) 2693(8) 44(1)
C(3) 5670(3) 715(1) 3005(7) 41(1)
C(4) 4614(3) 689(1) 2927(7) 42(1)
C(5) 4070(3) 987(1) 3211(7) 40(1)
C(6) 4586(3) 1308(1) 3556(7) 41(1)
C(7) 5621(3) 1320(1) 3598(7) 40(1)
C(8) 6171(3) 1016(1) 3336(7) 43(1)
C(9) 7296(3) 969(1) 3377(8) 49(1)
C(10) 9455(6) 544(2) 3691(15) 87(2)
C(11) 7549(5) 264(1) -1038(8)58(1)
C(12) 6663(6) 175(2) -1865(10) 81(2)
C(13) 6587(9) -147(3)-2720(13) 110(3)
C(14) 7391(11) -369(2)-2703(12) 113(4)
C(15) 8272(10) -271(2)-1900(13) 106(3)
C(16) 8359(6) 44(2)-1103(10) 83(2)
C(17) 2516(4) 721(1) 2403(10) 61(1)
C(18) 4421(5) 1912(1) 4109(9) 59(1)
S(3)3589(1) 2976(1) 11393(3) 68(1)
S(4)3287(1) 2850(1) 7109(2) 62(1)
F(4)1715(4) 3070(1) 12530(10) 118(2)
F(5)2703(5) 3494(1) 12757(10) 132(2)
F(6)2071(6) 3346(2) 10116(10) 148(2)
O(4) 4949(3) 2444(1) 10055(8) 71(1)
O(5) 3674(4) 1133(1) 8411(7) 76(1)
O(6) 1757(4) 1223(1) 8322(7) 74(1)
C(19) 3258(4) 2674(1) 9526(8) 51(1)
C(20) 4063(4) 2387(1) 9674(8) 52(1)
C(21) 3561(3) 2063(1) 9294(7) 48(1)
C(22) 3990(4) 1743(2) 9043(7) 54(1)
C(23) 3370(4) 1463(2) 8717(8) 59(1)
C(24) 2292(4) 1509(2) 8664(8) 55(1)
C(25) 1886(4) 1836(1) 8922(8) 51(1)
C(26) 2518(3) 2113(1) 9256(7) 48(1)
C(27) 2240(4) 2483(1) 9652(9) 55(1)
C(28) 2485(7) 3226(2) 11641(13) 93(2)
C(29) 4553(4) 2994(1) 6772(8) 48(1)
C(30) 4820(4) 3327(2) 7105(10) 62(1)
C(31) 5788(5) 3440(2) 6763(10) 70(2)
C(32) 6499(5) 3217(2) 6087(10) 72(2)
C(33) 6247(5) 2879(2) 5710(10) 76(2)

C(34) 5283(5) 2762(2) 6039(9) 64(2)
C(35) 4729(5) 1067(2) 8402(10) 76(2)
C(36) 686(6) 1248(2) 8184(13) 87(2)

Table 3. Bond lengths [Å ] and angles [°] for DM15546.

S(1)-C(1) 1.801(5)
S(1)-C(10) 1.738(7)
S(2)-C(1) 1.858(6)
S(2)-C(11) 1.776(6)
F(1)-C(10) 1.290(11)
F(2)-C(10) 1.268(9)
F(3)-C(10) 1.286(10)
O(1)-C(2) 1.201(5)
O(2)-C(5) 1.353(5)
O(2)-C(17) 1.423(6)
O(3)-C(6) 1.351(5)
O(3)-C(18) 1.426(6)
C(1)-C(2) 1.552(6)
C(1)-C(9) 1.536(6)
C(2)-C(3) 1.474(6)
C(3)-C(4) 1.396(6)
C(3)-C(8) 1.359(6)
C(4)-H(4) 0.9300
C(4)-C(5) 1.372(6)
C(5)-C(6) 1.435(6)
C(6)-C(7) 1.364(6)
C(7)-H(7) 0.9300
C(7)-C(8) 1.392(6)
C(8)-C(9) 1.494(6)
C(9)-H(9A) 0.9700
C(9)-H(9B) 0.9700
C(11)-C(12) 1.351(10)
C(11)-C(16) 1.366(9)
C(12)-H(12) 0.9300
C(12)-C(13) 1.388(11)
C(13)-H(13) 0.9300
C(13)-C(14) 1.364(15)
C(14)-H(14) 0.9300
C(14)-C(15) 1.346(15)
C(15)-H(15) 0.9300
C(15)-C(16) 1.347(12)

C(16)-H(16) 0.9300
C(17)-H(17A) 0.9600
C(17)-H(17B) 0.9600
C(17)-H(17C) 0.9600
C(18)-H(18A) 0.9600
C(18)-H(18B) 0.9600
C(18)-H(18C) 0.9600
S(3)-C(19) 1.819(6)
S(3)-C(28) 1.756(9)
S(4)-C(19) 1.847(6)
S(4)-C(29) 1.773(5)
F(4)-C(28) 1.339(10)
F(5)-C(28) 1.336(10)
F(6)-C(28) 1.297(10)
O(4)-C(20) 1.218(6)
O(5)-C(23) 1.352(7)
O(5)-C(35) 1.413(8)
O(6)-C(24) 1.335(7)
O(6)-C(36) 1.417(9)
C(19)-C(20) 1.538(7)
C(19)-C(27) 1.534(7)
C(20)-C(21) 1.443(7)
C(21)-C(22) 1.372(8)
C(21)-C(26) 1.387(6)
C(22)-H(22) 0.9300
C(22)-C(23) 1.375(8)
C(23)-C(24) 1.431(8)
C(24)-C(25) 1.384(8)
C(25)-H(25) 0.9300
C(25)-C(26) 1.379(7)
C(26)-C(27) 1.500(7)
C(27)-H(27A) 0.9700
C(27)-H(27B) 0.9700
C(29)-C(30) 1.356(7)
C(29)-C(34) 1.415(8)
C(30)-H(30) 0.9300
C(30)-C(31) 1.370(8)
C(31)-H(31) 0.9300
C(31)-C(32) 1.360(10)
C(32)-H(32) 0.9300
C(32)-C(33) 1.374(10)
C(33)-H(33) 0.9300

C(33)-C(34) 1.369(9)
C(34)-H(34) 0.9300
C(35)-H(35A) 0.9600
C(35)-H(35B) 0.9600
C(35)-H(35C) 0.9600
C(36)-H(36A) 0.9600
C(36)-H(36B) 0.9600
C(36)-H(36C) 0.9600
C(10)-S(1)-C(1) 103.4(3)
C(11)-S(2)-C(1) 103.7(2)
C(5)-O(2)-C(17) 116.5(4)
C(6)-O(3)-C(18) 118.0(4)
S(1)-C(1)-S(2) 115.4(3)
C(2)-C(1)-S(1) 104.7(3)
C(2)-C(1)-S(2) 107.2(3)
C(9)-C(1)-S(1) 118.4(4)
C(9)-C(1)-S(2) 105.7(3)
C(9)-C(1)-C(2) 104.5(4)
O(1)-C(2)-C(1) 123.9(4)
O(1)-C(2)-C(3) 130.8(4)
C(3)-C(2)-C(1) 105.4(3)
C(4)-C(3)-C(2) 126.1(4)
C(8)-C(3)-C(2) 110.4(4)
C(8)-C(3)-C(4) 123.5(4)
C(3)-C(4)-H(4) 121.5
C(5)-C(4)-C(3) 117.0(4)
C(5)-C(4)-H(4) 121.5
O(2)-C(5)-C(4) 125.0(4)
O(2)-C(5)-C(6) 114.7(4)
C(4)-C(5)-C(6) 120.2(4)
O(3)-C(6)-C(5) 114.6(4)
O(3)-C(6)-C(7) 125.0(4)
C(7)-C(6)-C(5) 120.5(4)
C(6)-C(7)-H(7) 120.4
C(6)-C(7)-C(8) 119.2(4)
C(8)-C(7)-H(7) 120.4
C(3)-C(8)-C(7) 119.6(4)
C(3)-C(8)-C(9) 112.3(4)
C(7)-C(8)-C(9) 128.1(4)
C(1)-C(9)-H(9A) 111.0
C(1)-C(9)-H(9B) 111.0
C(8)-C(9)-C(1) 103.6(4)

C(8)-C(9)-H(9A) 111.0
C(8)-C(9)-H(9B) 111.0
H(9A)-C(9)-H(9B) 109.0
F(1)-C(10)-S(1) 116.4(6)
F(2)-C(10)-S(1) 113.3(6)
F(2)-C(10)-F(1) 105.6(8)
F(2)-C(10)-F(3) 104.7(7)
F(3)-C(10)-S(1) 117.0(7)
F(3)-C(10)-F(1) 98.0(8)
C(12)-C(11)-S(2) 119.8(5)
C(12)-C(11)-C(16) 120.0(7)
C(16)-C(11)-S(2) 120.0(6)
C(11)-C(12)-H(12) 120.6
C(11)-C(12)-C(13) 118.8(9)
C(13)-C(12)-H(12) 120.6
C(12)-C(13)-H(13) 119.9
C(14)-C(13)-C(12) 120.3(10)
C(14)-C(13)-H(13) 119.9
C(13)-C(14)-H(14) 120.1
C(15)-C(14)-C(13) 119.8(8)
C(15)-C(14)-H(14) 120.1
C(14)-C(15)-H(15) 119.9
C(14)-C(15)-C(16) 120.3(10)
C(16)-C(15)-H(15) 119.9
C(11)-C(16)-H(16) 119.6
C(15)-C(16)-C(11) 120.8(10)
C(15)-C(16)-H(16) 119.6
O(2)-C(17)-H(17A) 109.5
O(2)-C(17)-H(17B) 109.5
O(2)-C(17)-H(17C) 109.5
H(17A)-C(17)-H(17B) 109.5
H(17A)-C(17)-H(17C) 109.5
H(17B)-C(17)-H(17C) 109.5
O(3)-C(18)-H(18A) 109.5
O(3)-C(18)-H(18B) 109.5
O(3)-C(18)-H(18C) 109.5
H(18A)-C(18)-H(18B) 109.5
H(18A)-C(18)-H(18C) 109.5
H(18B)-C(18)-H(18C) 109.5
C(28)-S(3)-C(19) 103.2(3)
C(29)-S(4)-C(19) 105.1(2)
C(23)-O(5)-C(35) 117.5(5)

C(24)-O(6)-C(36) 118.7(5)
S(3)-C(19)-S(4) 115.9(3)
C(20)-C(19)-S(3) 104.3(4)
C(20)-C(19)-S(4) 108.4(4)
C(27)-C(19)-S(3) 118.4(4)
C(27)-C(19)-S(4) 104.5(4)
C(27)-C(19)-C(20) 104.5(4)
O(4)-C(20)-C(19) 123.0(5)
O(4)-C(20)-C(21) 129.7(5)
C(21)-C(20)-C(19) 107.3(4)
C(22)-C(21)-C(20) 128.2(4)
C(22)-C(21)-C(26) 122.2(5)
C(26)-C(21)-C(20) 109.5(5)
C(21)-C(22)-H(22) 120.4
C(21)-C(22)-C(23) 119.2(5)
C(23)-C(22)-H(22) 120.4
O(5)-C(23)-C(22) 126.4(5)
O(5)-C(23)-C(24) 114.0(5)
C(22)-C(23)-C(24) 119.6(5)
O(6)-C(24)-C(23) 115.1(5)
O(6)-C(24)-C(25) 125.3(5)
C(25)-C(24)-C(23) 119.6(5)
C(24)-C(25)-H(25) 120.0
C(26)-C(25)-C(24) 120.0(5)
C(26)-C(25)-H(25) 120.0
C(21)-C(26)-C(27) 111.9(4)
C(25)-C(26)-C(21) 119.4(5)
C(25)-C(26)-C(27) 128.7(4)
C(19)-C(27)-H(27A) 111.1
C(19)-C(27)-H(27B) 111.1
C(26)-C(27)-C(19) 103.5(4)
C(26)-C(27)-H(27A) 111.1
C(26)-C(27)-H(27B) 111.1
H(27A)-C(27)-H(27B)109.0
F(4)-C(28)-S(3) 115.1(6)
F(5)-C(28)-S(3) 108.0(7)
F(5)-C(28)-F(4) 103.5(7)
F(6)-C(28)-S(3) 117.4(6)
F(6)-C(28)-F(4) 103.7(8)
F(6)-C(28)-F(5) 108.1(7)
C(30)-C(29)-S(4) 121.2(4)
C(30)-C(29)-C(34) 119.4(5)

C(34)-C(29)-S(4) 119.3(4)
C(29)-C(30)-H(30) 119.6
C(29)-C(30)-C(31) 120.9(6)
C(31)-C(30)-H(30) 119.6
C(30)-C(31)-H(31) 120.0
C(32)-C(31)-C(30) 120.1(6)
C(32)-C(31)-H(31) 120.0
C(31)-C(32)-H(32) 119.8
C(31)-C(32)-C(33) 120.4(6)
C(33)-C(32)-H(32) 119.8
C(32)-C(33)-H(33) 119.8
C(34)-C(33)-C(32) 120.4(6)
C(34)-C(33)-H(33) 119.8
C(29)-C(34)-H(34) 120.5
C(33)-C(34)-C(29) 118.9(6)
C(33)-C(34)-H(34) 120.5
O(5)-C(35)-H(35A) 109.5
O(5)-C(35)-H(35B) 109.5
O(5)-C(35)-H(35C) 109.5
H(35A)-C(35)-H(35B)109.5
H(35A)-C(35)-H(35C)109.5
H(35B)-C(35)-H(35C)109.5
O(6)-C(36)-H(36A) 109.5
O(6)-C(36)-H(36B) 109.5
O(6)-C(36)-H(36C) 109.5
H(36A)-C(36)-H(36B)109.5
H(36A)-C(36)-H(36C)109.5
H(36B)-C(36)-H(36C)109.5

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Symmetry transformations used to generate equivalent atoms:

Table 4. Anisotropic displacement parameters (Å 2x 103) for DM15546. The anisotropic displacement factor exponent takes the form: -2 2[ h2 a*2U11 + ... + 2 h k a* b* U12 ]

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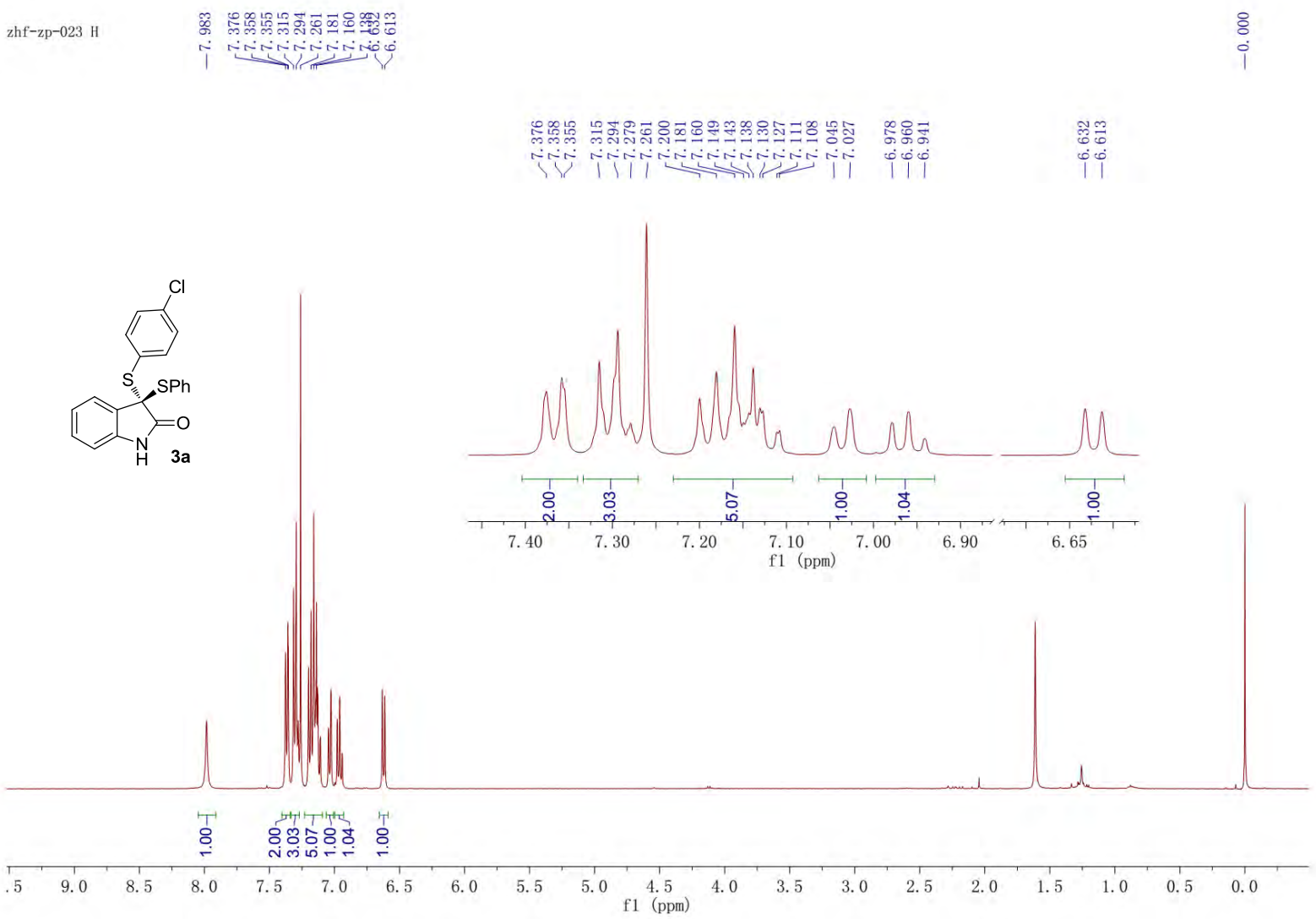
| | U11 | U22 | U33 | U23 | U13 | U12 |
|---|---|---|---|---|---|---|
| S(1) | 44(1) | 48(1) | 76(1) | 9(1) | -8(1) | 2(1) |
| S(2) | 65(1) | 47(1) | 65(1) | 10(1) | 5(1) | -2(1) |
| F(1) | 97(4) | 263(6) | 172(5) | 42(5) | -21(4) | -86(4) |
| F(2) | 64(2) | 109(3) | 182(5) | 20(3) | -51(3) | 8(2) |
| F(3) | 83(3) | 95(3) | 254(6) | -15(4) | -37(4) | -15(3) |
| O(1) | 49(2) | 35(2) | 101(3) | 4(2) | 3(2) | -6(1) |
| O(2) | 34(2) | 48(2) | 81(3) | -7(2) | -2(2) | 0(1) |

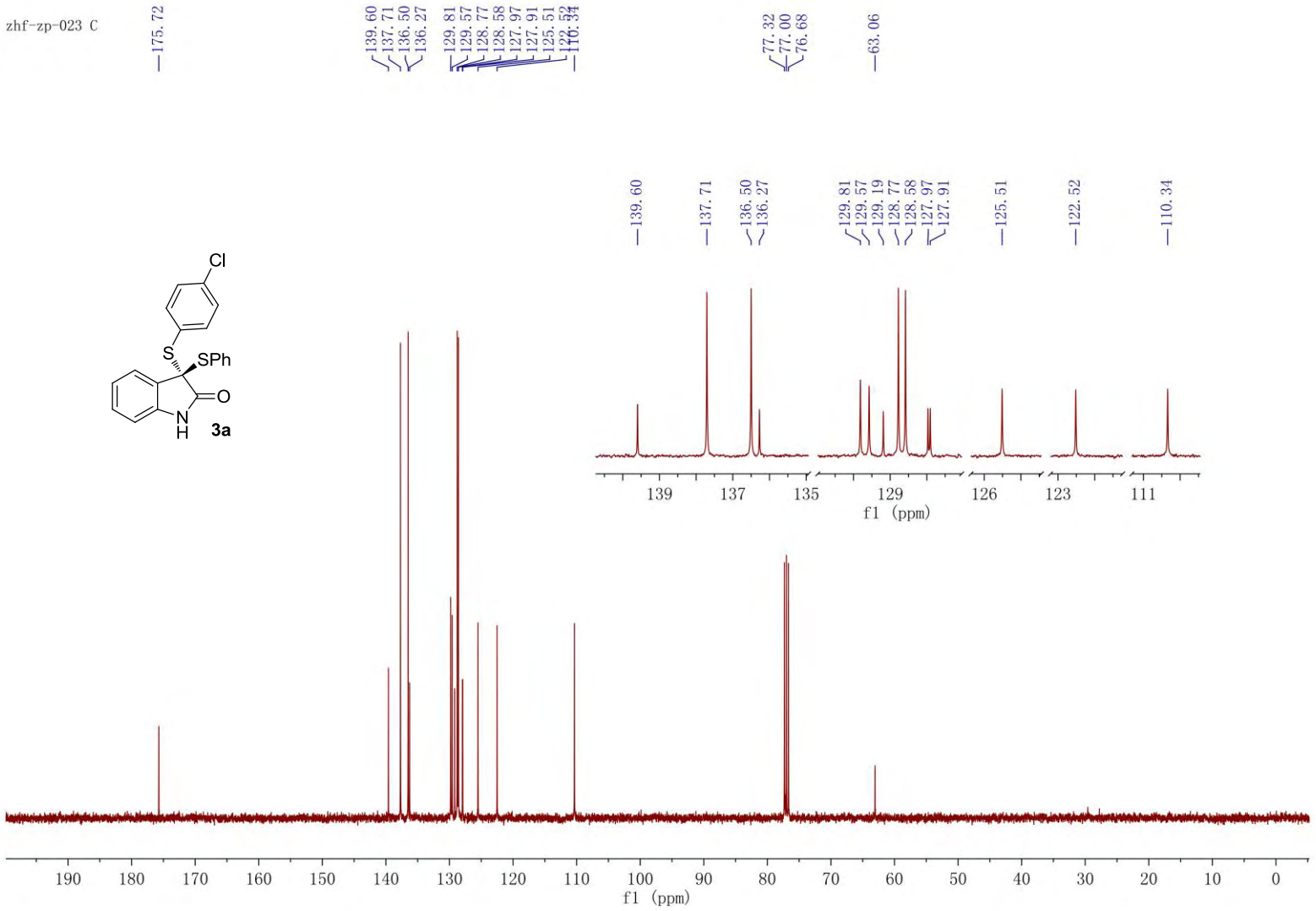
O(3) 48(2) 41(2)74(2) -10(2)-2(2) 5(1)
C(1) 36(2) 33(2)66(3) 0(2)-6(2) -3(2)
C(2) 40(2) 33(2)60(3) 1(2)0(2) -4(2)
C(3) 37(2) 35(2)50(2) 1(2)-2(2) -5(2)
C(4) 35(2) 41(2)50(2) -4(2)1(2) -5(2)
C(5) 36(2) 40(2)44(3) -1(2)1(2) -5(2)
C(6) 45(2) 34(2)44(2) -4(2)2(2) 4(2)
C(7) 45(2) 28(2)48(2) 0(2)3(2) -6(2)
C(8) 37(2) 38(2)55(3) 3(2)-1(2) -2(2)
C(9) 39(2) 38(2)71(3) 0(2)-5(2) -5(2)
C(10) 60(3) 79(3)122(4) 14(3)-24(3) -17(3)
C(11) 70(3) 50(3)56(3) 4(2)15(3) -2(3)
C(12) 80(4) 91(5)71(4) -23(4)6(4) -13(4)
C(13) 140(9) 106(7) 86(6) -18(5)-1(6) -44(7)
C(14) 216(13) 62(5)61(5) -5(4)33(7) -18(7)
C(15) 175(10) 68(5)75(5) 7(4)42(6) 37(6)
C(16) 100(5) 82(4)69(4) 18(3)30(4) 36(4)
C(17) 42(3) 56(3)84(4) -8(3)-3(3) -6(2)
C(18) 65(3) 41(3)70(4) -8(2)-6(3) 4(2)
S(3)57(1) 76(1)70(1) -3(1)-4(1) -11(1)
S(4)42(1) 73(1)71(1) 19(1)-10(1) -14(1)
F(4)87(3) 107(3) 159(5) -24(3)32(3) -1(3)
F(5)144(4) 94(3)160(5) -58(3)8(4) -3(3)
F(6)171(5) 146(4) 128(4) 14(4)-6(4) 86(4)
O(4) 31(2) 84(3)99(3) 16(3)-6(2) -9(2)
O(5) 75(3) 64(2)90(3) -6(2)-3(3) 14(2)
O(6) 70(3) 61(2)90(3) 5(2)-10(2) -12(2)
C(19) 36(2) 50(3)68(3) 6(2)1(2) -6(2)
C(20) 36(2) 60(3)60(3) 7(3)2(2) -3(2)
C(21) 35(2) 60(3)50(3) 13(2)0(2) -2(2)
C(22) 45(2) 67(3)49(3) 12(2)0(2) 0(2)
C(23) 61(3) 63(3)53(3) 9(3)2(3) 7(3)
C(24) 56(3) 58(3)50(3) 5(2)-3(2) -11(2)
C(25) 39(2) 59(3)55(3) 5(2)2(2) -8(2)
C(26) 36(2) 60(3)47(2) 8(2)3(2) -3(2)
C(27) 34(2) 57(3)75(4) 5(3)4(2) -7(2)
C(28) 102(4) 82(4)96(4) -13(3)5(4) 13(3)
C(29) 40(2) 50(3)56(3) 6(2)-3(2) -7(2)
C(30) 52(3) 52(3)82(4) -3(3)2(3) -6(2)
C(31) 70(4) 60(3)81(4) 3(3)-2(3) -26(3)
C(32) 49(3) 92(5)75(4) 24(4)6(3) -12(3)
C(33) 62(4) 98(5)69(4) 12(4)16(3) 13(4)

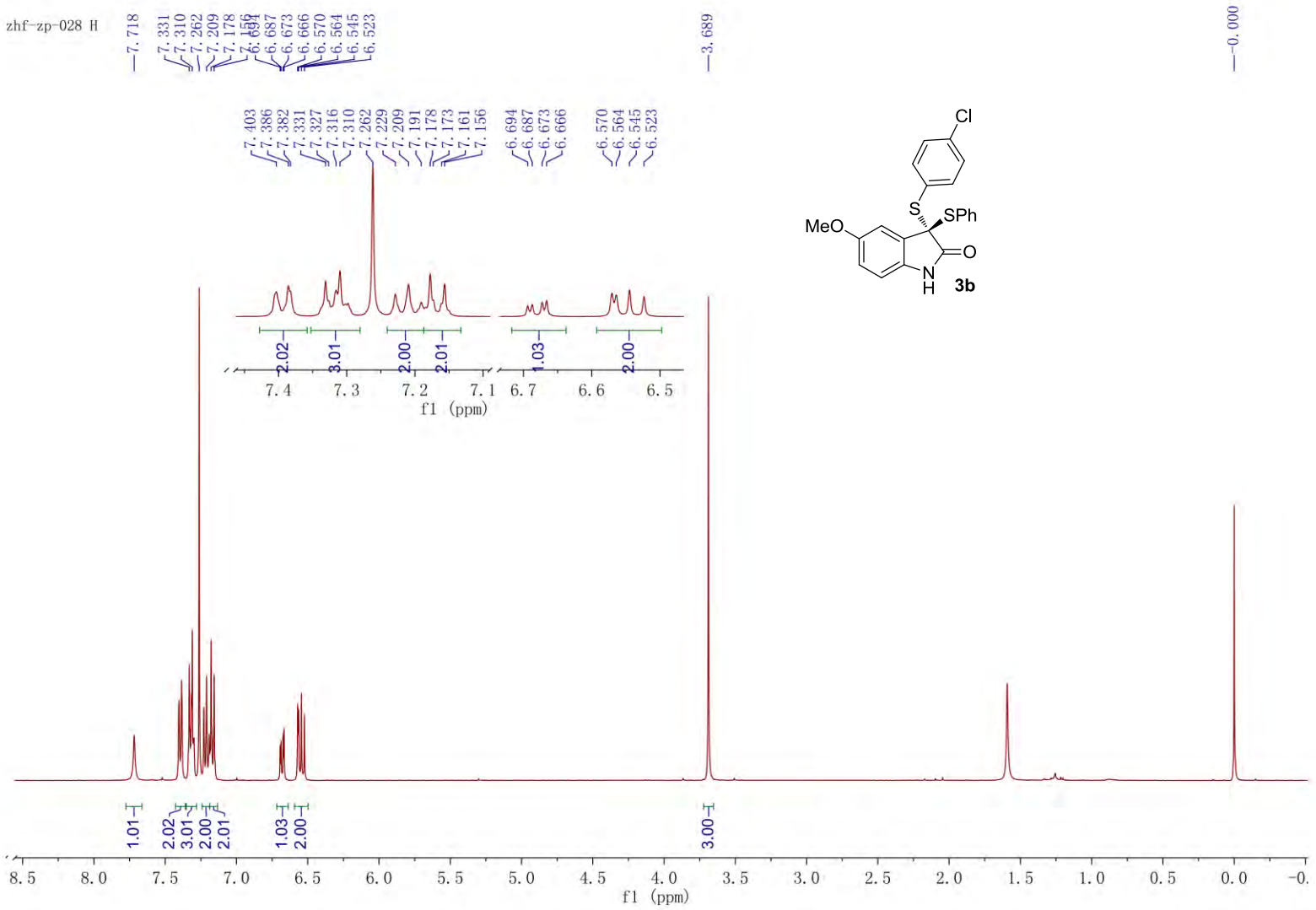
| | | | | | | |
|---|---|---|---|---|---|---|
| C(34) | 76(4) | 46(3) | 69(4) | -4(3) | 10(3) | -5(3) |
| C(35) | 76(4) | 84(4) | 69(4) | 5(4) | 2(3) | 18(4) |
| C(36) | 74(4) | 78(4) | 109(6) | -8(4) | -10(4) | -32(4) |

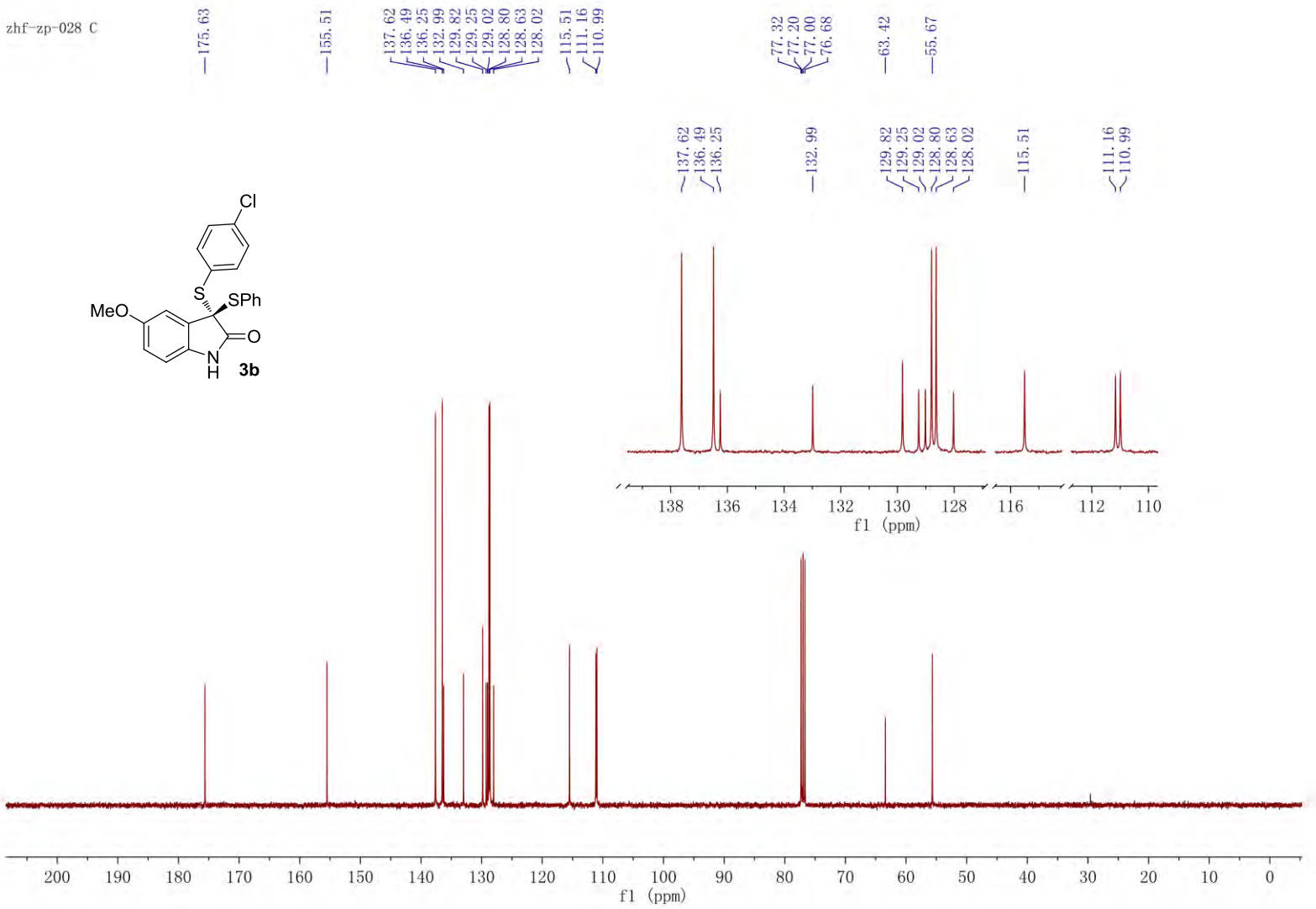
Table 5. Hydrogen coordinates ( x 104) and isotropic displacement parameters (Å 2x 10 3) for DM15546.

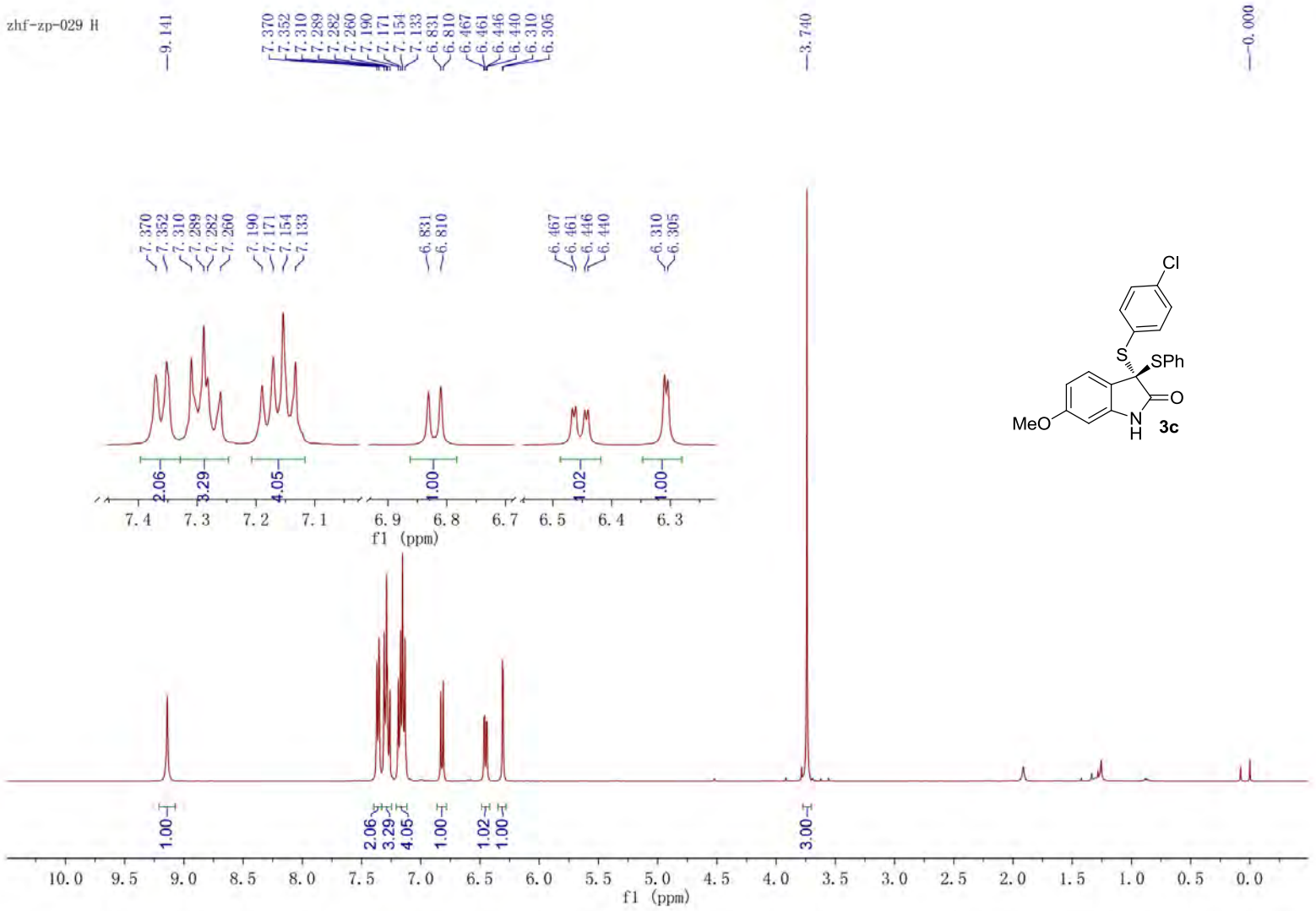
| | x | y | z | U(eq) |
|---|---|---|---|---|
| H(4) | 4293 | 479 | 2693 | 51 |
| H(7) | 5955 | 1529 | 3799 | 48 |
| H(9A) | 7553 | 978 | 4656 | 59 |
| H(9B) | 7634 | 1145 | 2631 | 59 |
| H(12) | 6115 | 327 | -1862 | 97 |
| H(13) | 5984 | -211 | -3307 | 132 |
| H(14) | 7332 | -587 | -3244 | 136 |
| H(15) | 8823 | -422 | -1895 | 127 |
| H(16) | 8977 | 111 | -590 | 100 |
| H(17A) | 2829 | 649 | 1247 | 91 |
| H(17B) | 1821 | 783 | 2168 | 91 |
| H(17C) | 2539 | 534 | 3294 | 91 |
| H(18A) | 4869 | 1966 | 3084 | 88 |
| H(18B) | 4800 | 1908 | 5264 | 88 |
| H(18C) | 3901 | 2086 | 4189 | 88 |
| H(22) | 4691 | 1715 | 9093 | 64 |
| H(25) | 1187 | 1868 | 8871 | 61 |
| H(27A) | 1944 | 2506 | 10896 | 66 |
| H(27B) | 1763 | 2569 | 8724 | 66 |
| H(30) | 4339 | 3481 | 7573 | 75 |
| H(31) | 5960 | 3670 | 6993 | 84 |
| H(32) | 7159 | 3294 | 5879 | 87 |
| H(33) | 6735 | 2729 | 5229 | 92 |
| H(34) | 5110 | 2533 | 5784 | 76 |
| H(35A) | 5037 | 1185 | 7356 | 115 |
| H(35B) | 4844 | 823 | 8288 | 115 |
| H(35C) | 5024 | 1149 | 9554 | 115 |
| H(36A) | 434 | 1065 | 7397 | 130 |
| H(36B) | 506 | 1467 | 7646 | 130 |
| H(36C) | 391 | 1228 | 9416 | 130 |

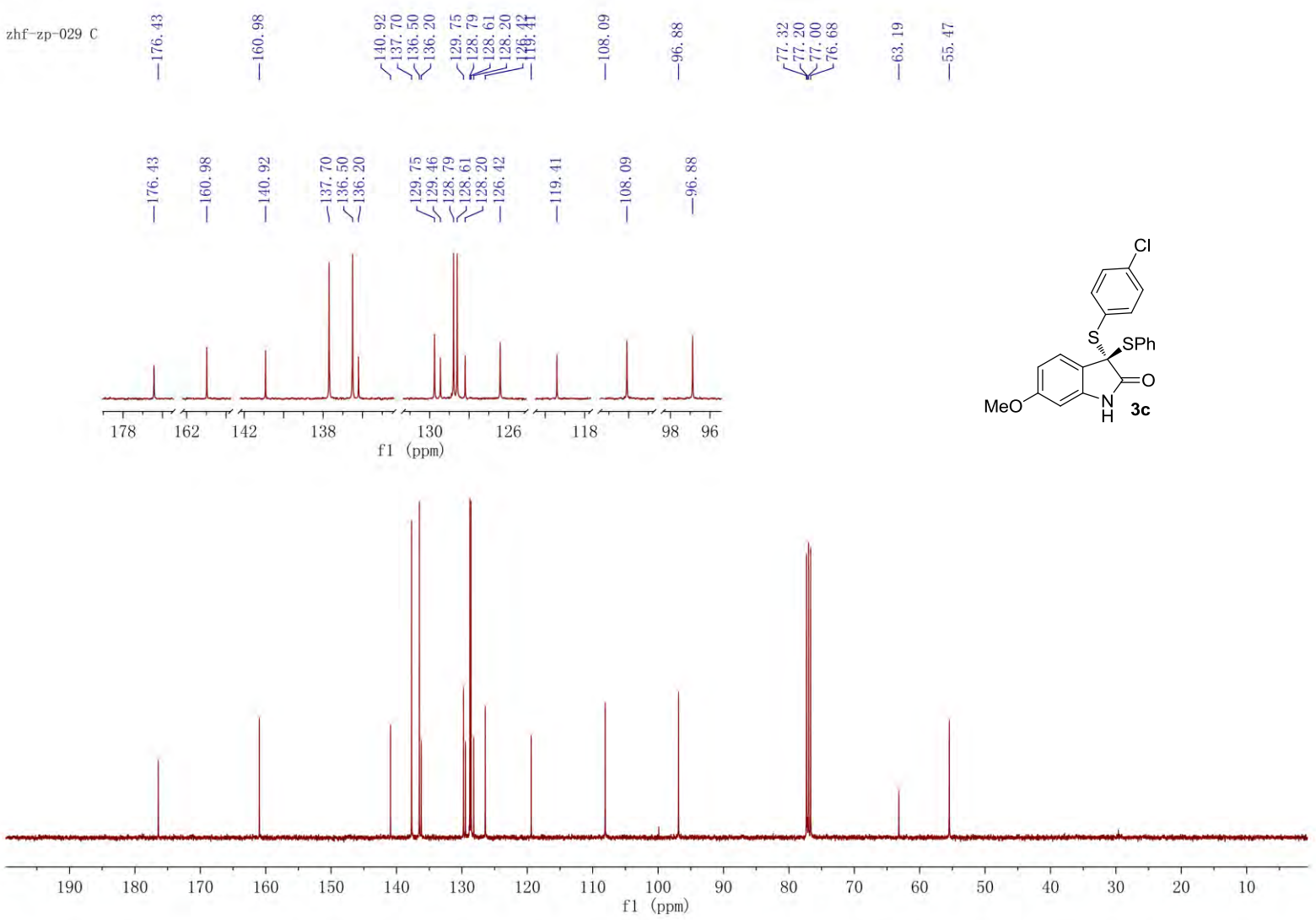

zhf-zp-023 H
7.983
7.376
7.358
7.355
7.315
7.294
7.261
7.181
7.160
6.632
6.613
0.000
Cl
S
SPh
O
N
H
3a
f1 (ppm)

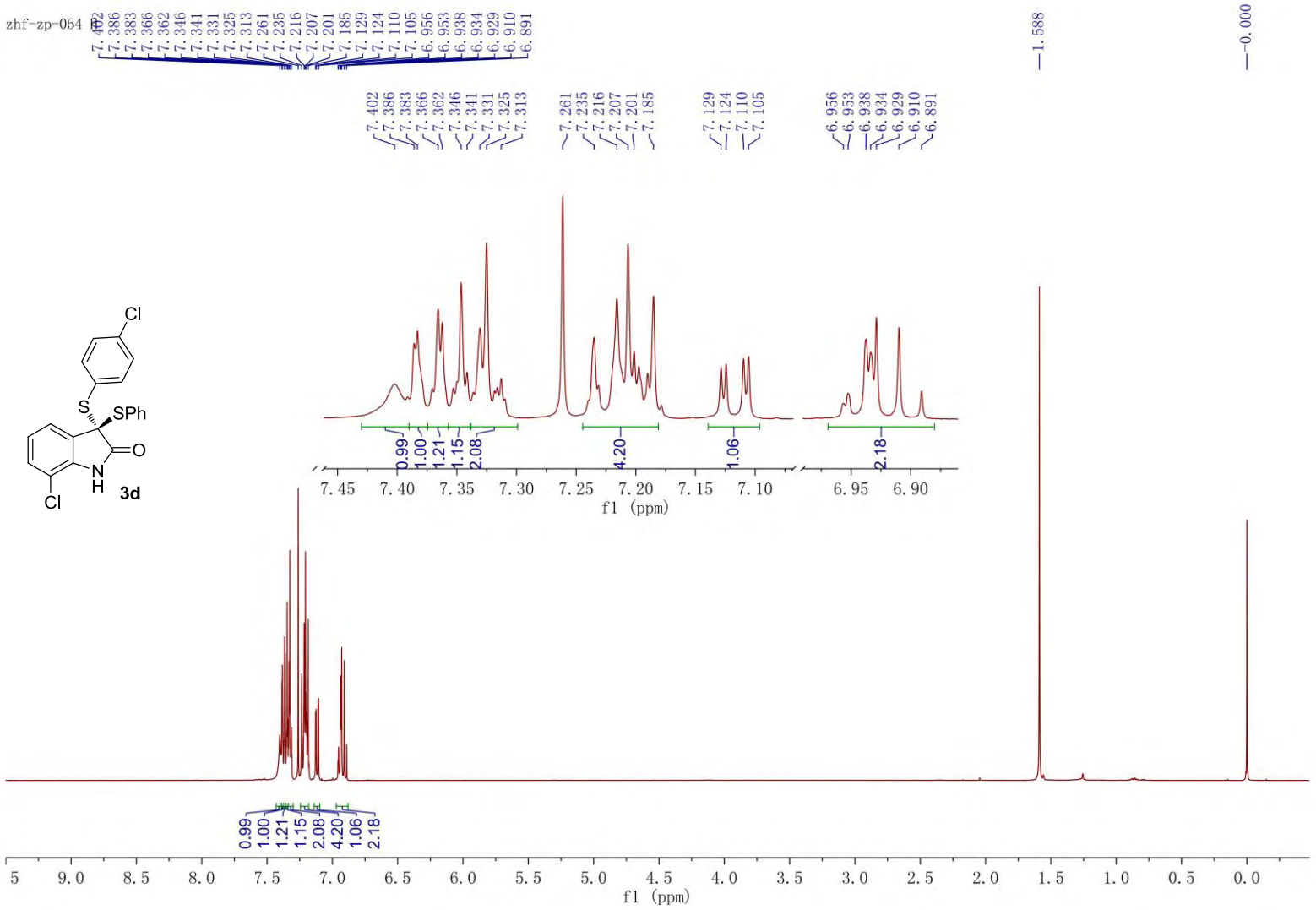

zhf-zp-023 C
175.72
139.60
137.71
136.50
136.27
129.81
129.57
128.77
128.58
127.97
127.91
125.51
122.52
110.34
77.32
77.00
76.68
63.06
Cl
S
SPh
O
N
H
3a
f1 (ppm)
f1 (ppm)

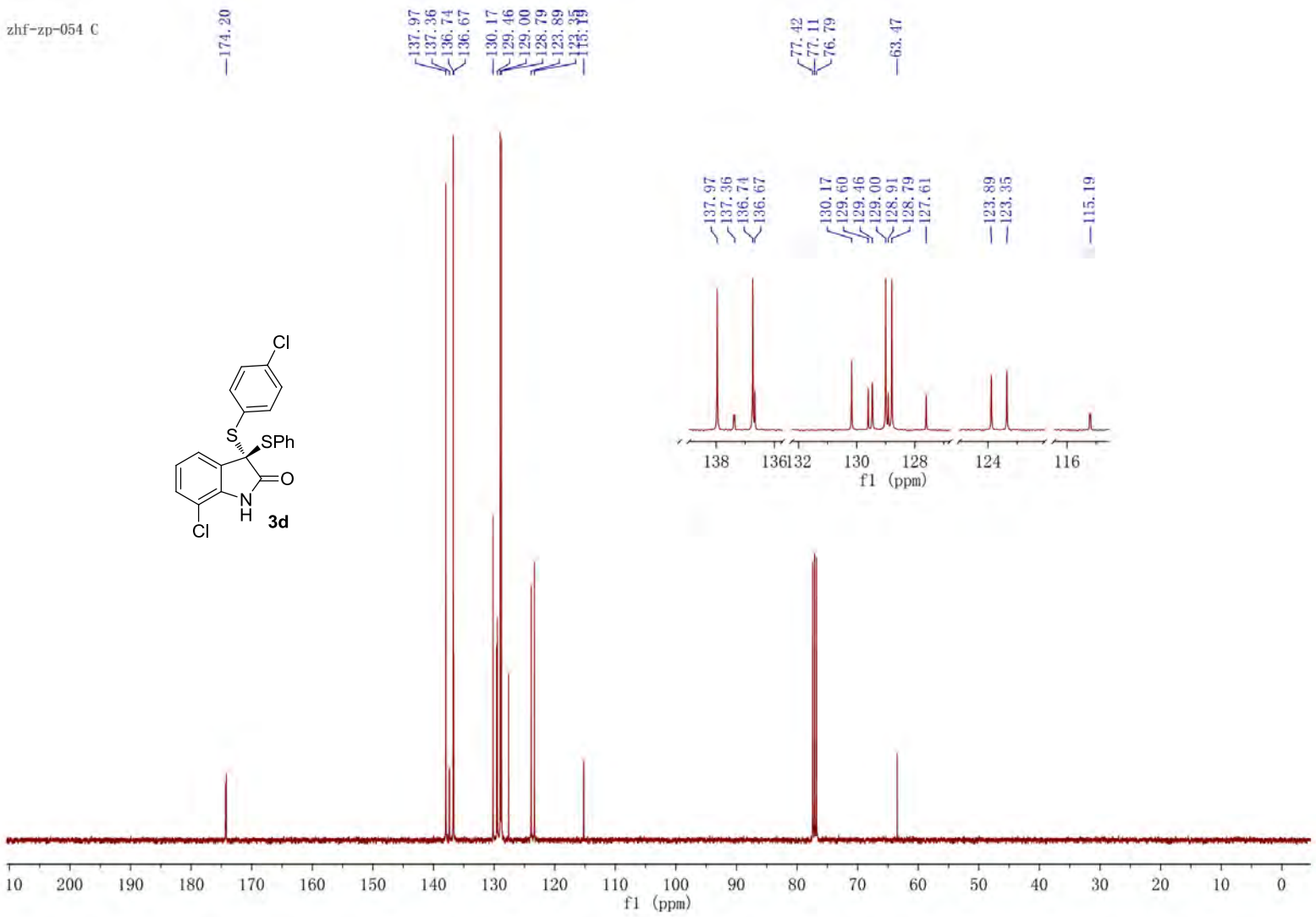

zhf-zp-028 H
7.718
7.331
7.310
7.262
7.209
7.178
7.156
6.694
6.687
6.673
6.666
6.570
6.564
6.545
6.523
3.689
0.000
7.403
7.386
7.382
7.331
7.327
7.316
7.310
7.262
7.229
7.209
7.191
7.178
7.173
7.161
7.156
6.694
6.687
6.673
6.666
6.570
6.564
6.545
6.523
2.02
3.01
2.00
2.01
1.03
2.00
f1 (ppm)
1.01
2.02
3.01
2.00
2.01
1.03
2.00
3.00
f1 (ppm)
Cl
S
SPh
MeO
O
N
H
3b

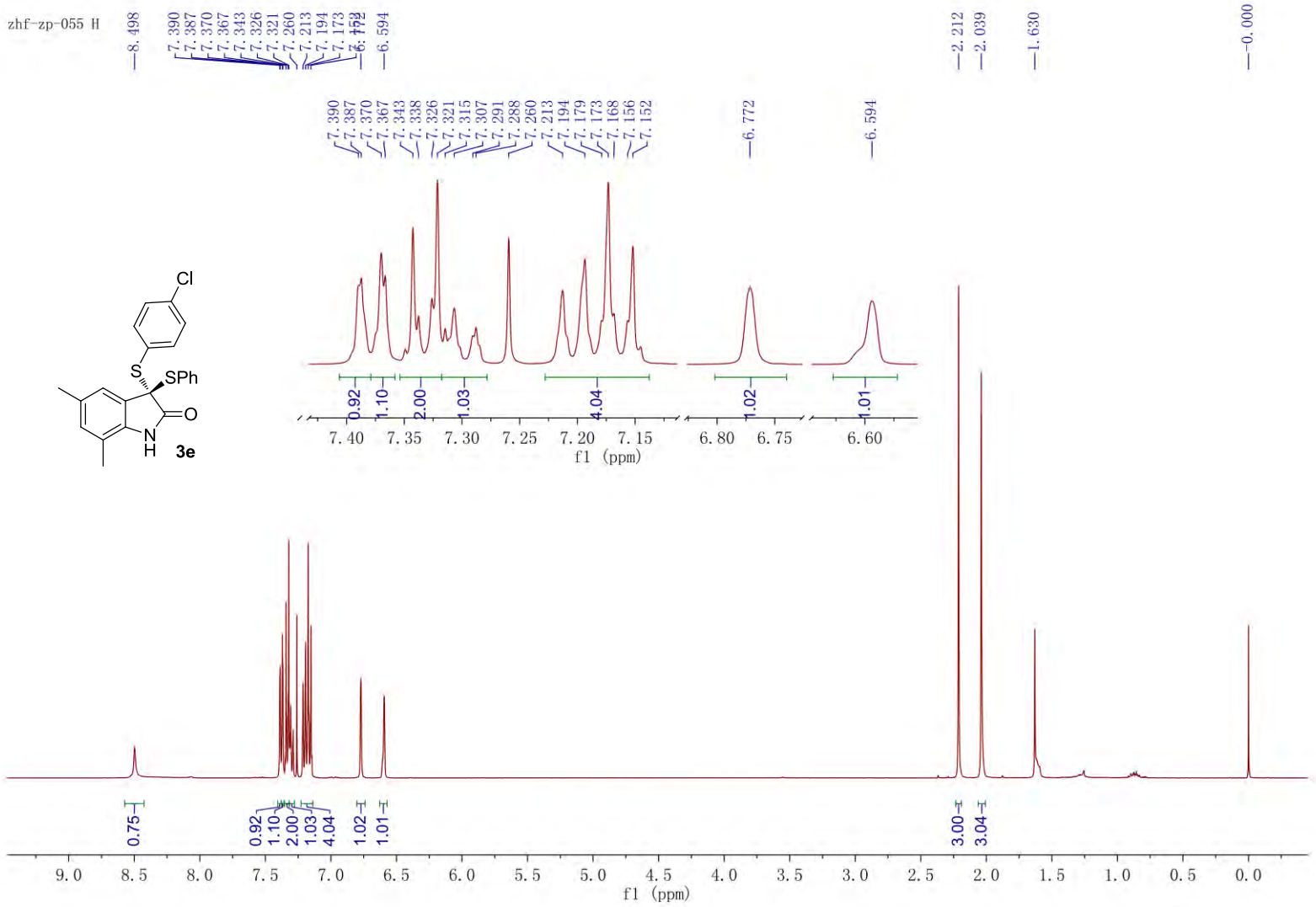

zhf-zp-028 C
175.63
155.51
137.62
136.49
136.25
132.99
129.82
129.25
129.02
128.80
128.63
128.02
115.51
111.16
110.99
77.32
77.20
77.00
76.68
63.42
55.67
Cl
S
SPh
MeO
O
N
H
3b
f1 (ppm)
f1 (ppm)

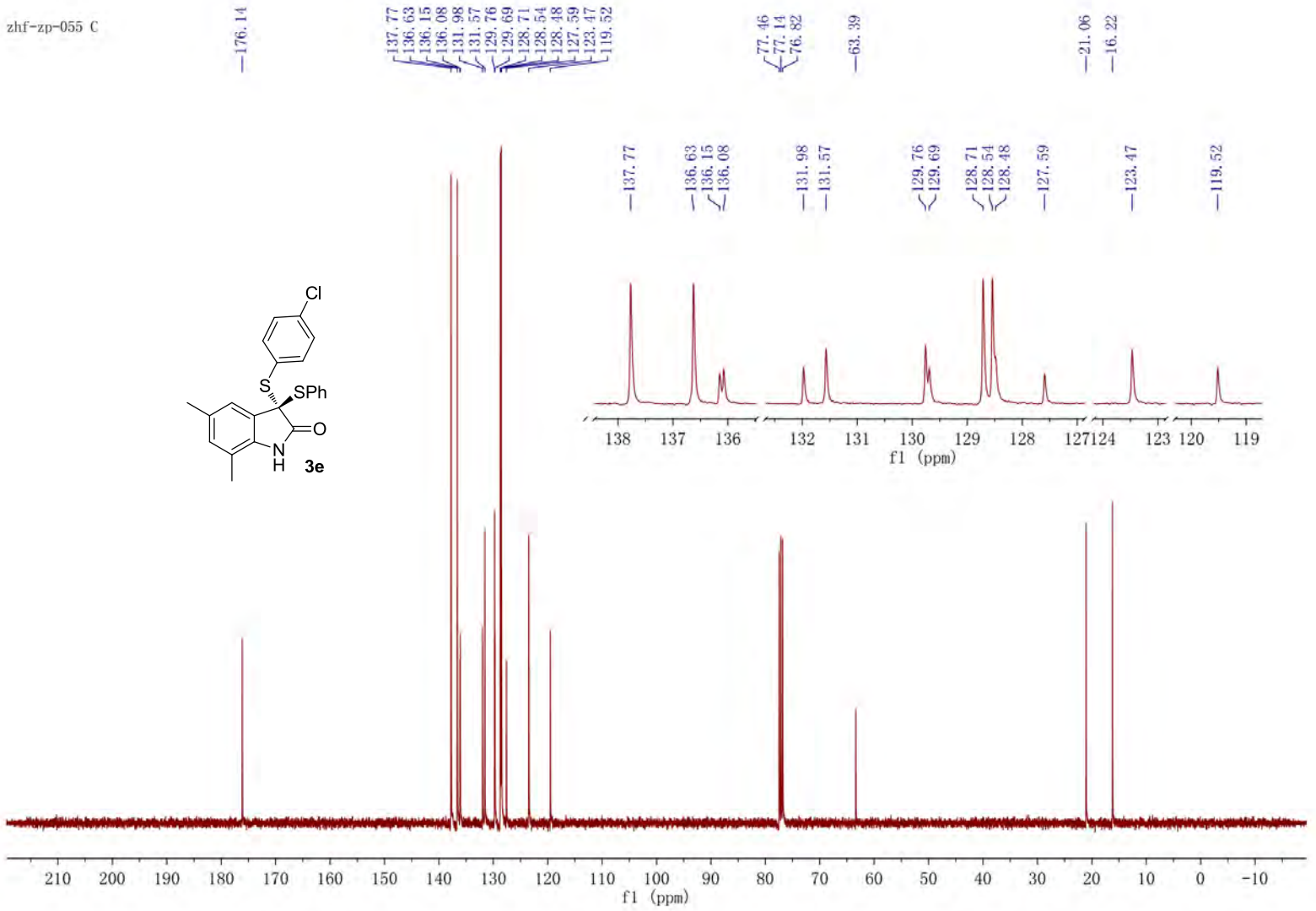

zhf-zp-029 H
9.141
7.370
7.352
7.310
7.289
7.282
7.260
7.190
7.171
7.154
7.133
6.831
6.810
6.467
6.461
6.446
6.440
6.310
6.305
3.740
0.000
2.06
3.29
4.05
1.00
1.02
1.00
3.00
f1 (ppm)
Cl
S
SPh
O
N
H
MeO
3c

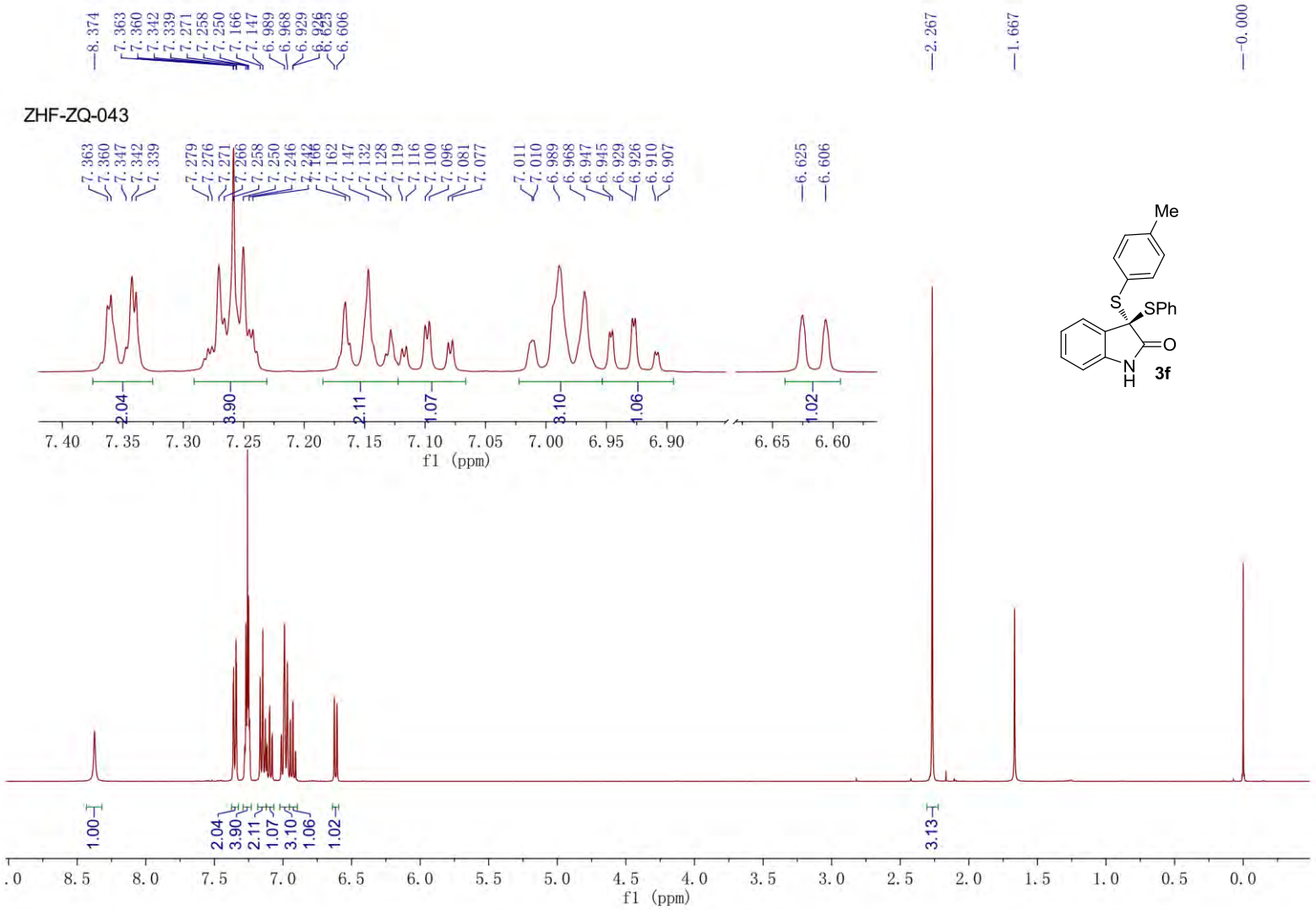

zhf-zp-029 C
176.43
160.98
140.92
137.70
136.50
136.20
129.75
128.79
128.61
128.20
126.42
119.41
108.09
96.88
77.32
77.20
77.00
76.68
63.19
55.47
f1 (ppm)
Cl
S
SPh
O
N
H
MeO
3c

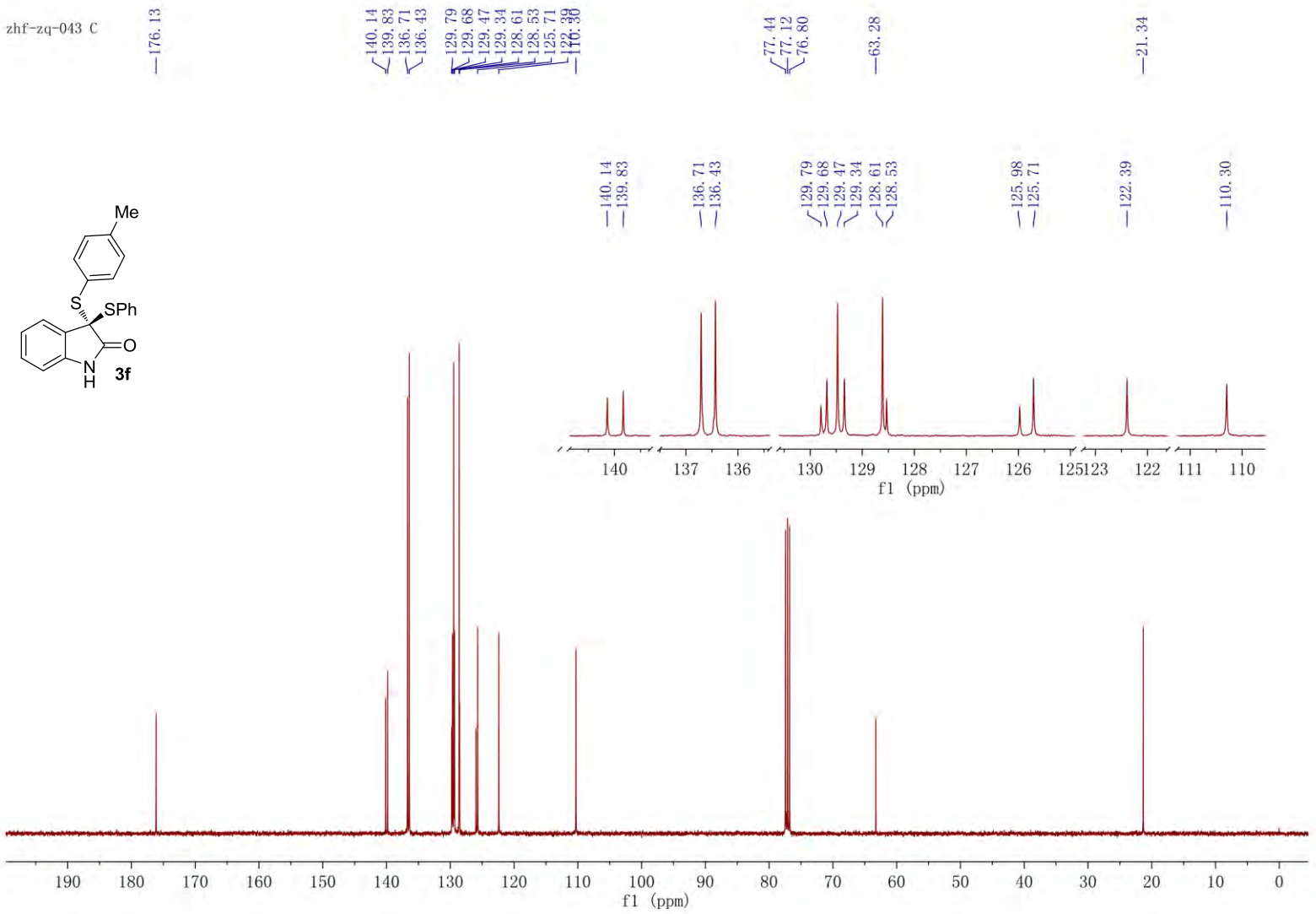

zhf-zp-054
7.402
7.386
7.383
7.366
7.362
7.346
7.341
7.331
7.325
7.313
7.261
7.235
7.216
7.207
7.201
7.185
7.129
7.124
7.110
7.105
6.956
6.953
6.938
6.934
6.929
6.910
6.891
1.588
0.000
Cl
S
SPh
O
N
H
Cl
3d
0.99
1.00
1.21
1.15
2.08
4.20
1.06
2.18
7.45
7.40
7.35
7.30
7.25
7.20
7.15
7.10
6.95
6.90
f1 (ppm)
5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

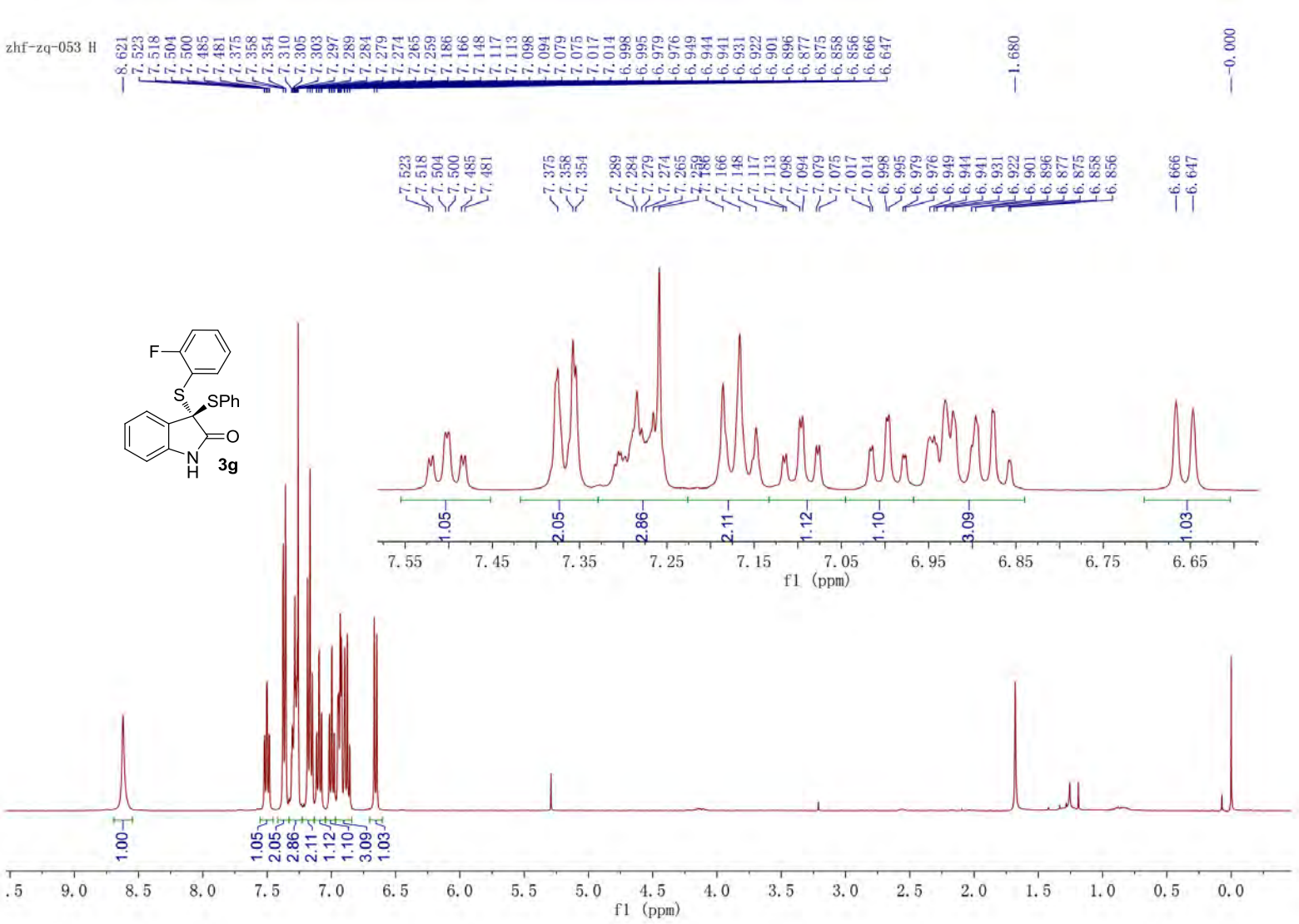

zhf-zp-054 C
174.20
137.97
137.36
136.74
136.67
130.17
129.46
129.00
128.79
123.89
123.35
115.19
77.42
77.11
76.79
63.47
Cl
S
SPh
O
N
H
Cl
3d
137.97
137.36
136.74
136.67
130.17
129.60
129.46
129.00
128.91
128.79
127.61
123.89
123.35
115.19
138
136
132
130
128
124
116
f1 (ppm)
10
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

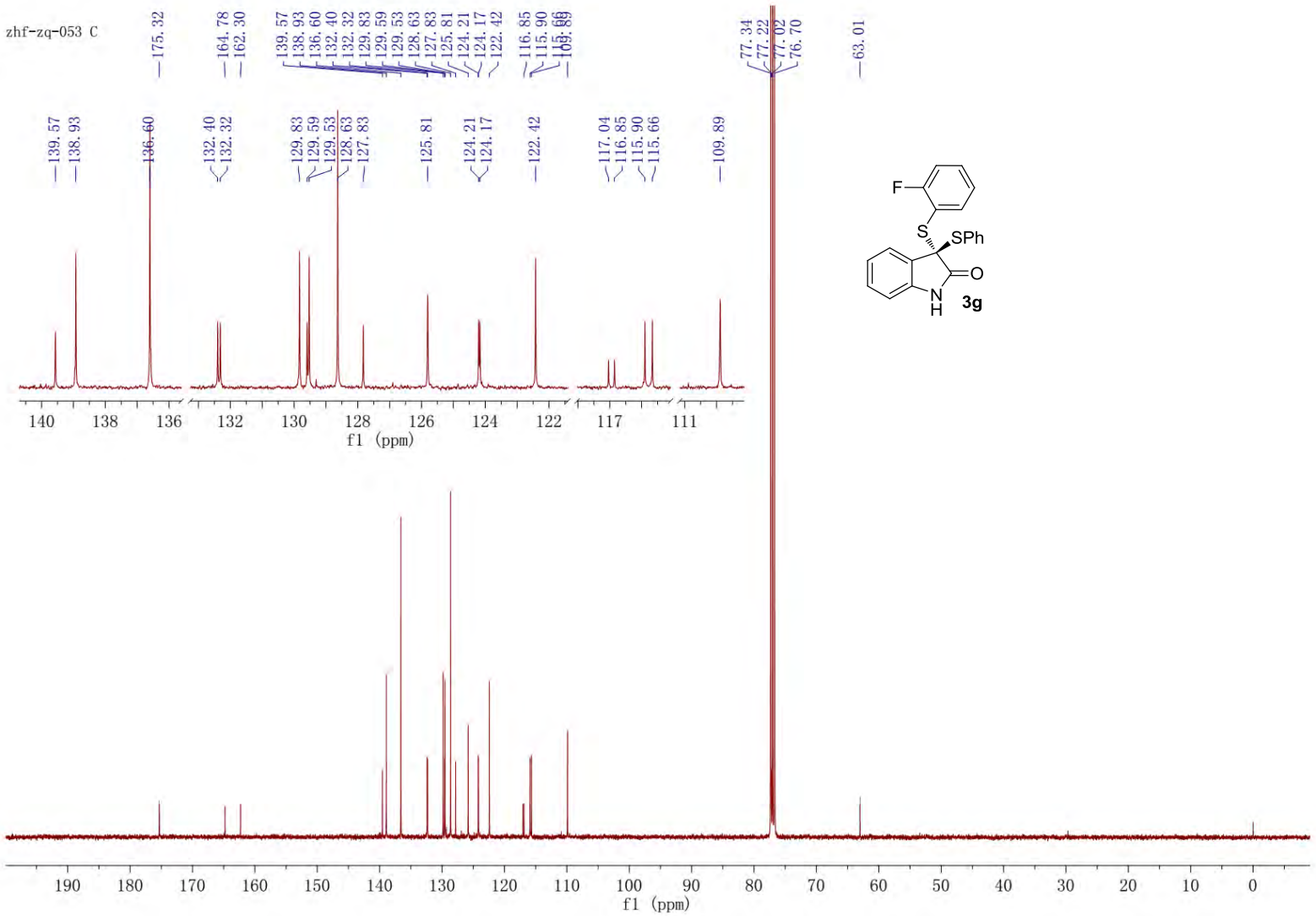

zhf-zp-055 H
8.498
7.390
7.387
7.370
7.367
7.343
7.326
7.321
7.260
7.213
7.194
7.173
6.594
2.212
2.039
1.630
0.000
6.772
6.594
Cl
S
SPh
O
N
H
3e
0.92
1.10
2.00
1.03
4.04
1.02
1.01
3.00
3.04
f1 (ppm)

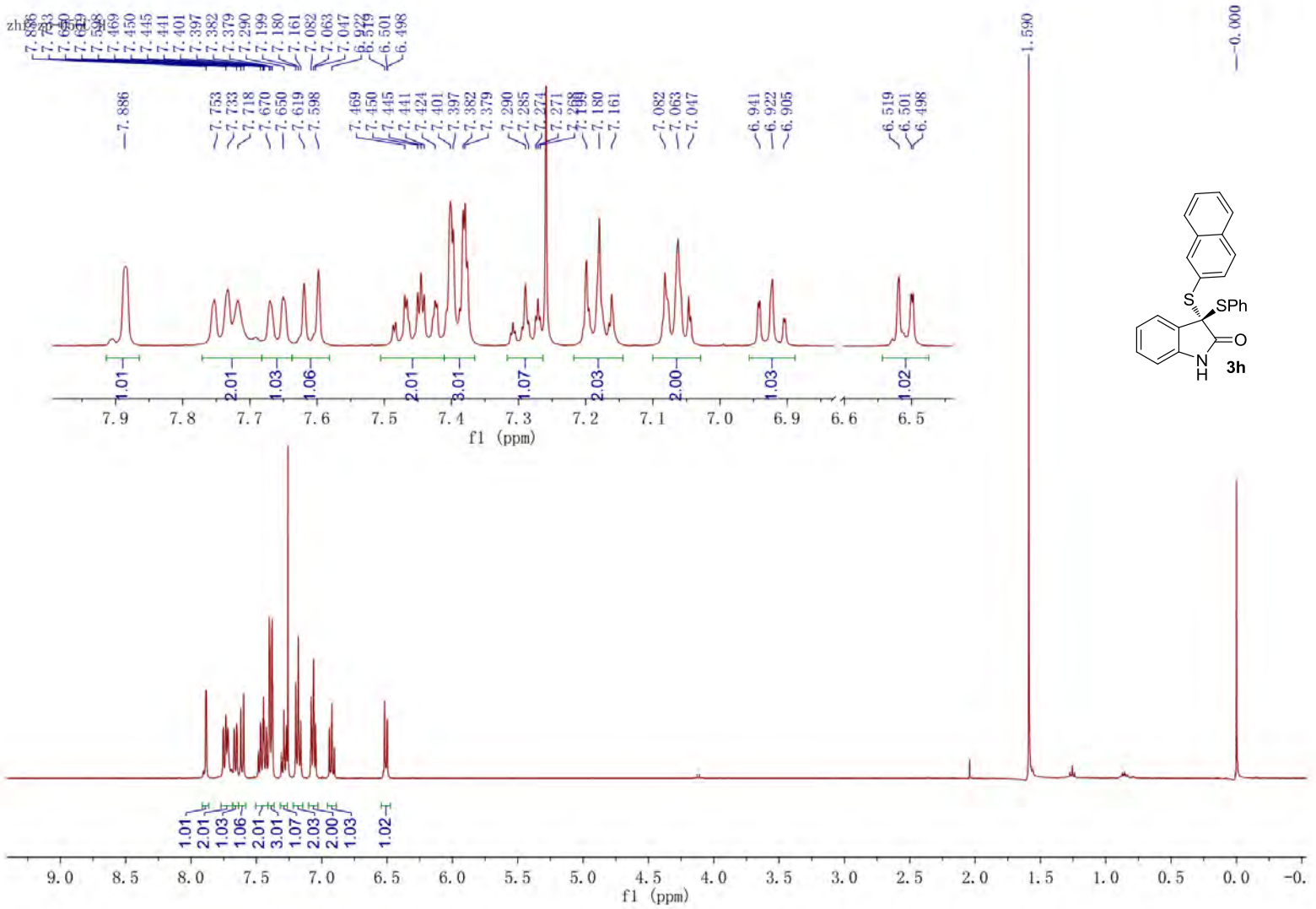

zhf-zp-055 C
176.14
137.77
136.63
136.15
136.08
131.98
131.57
129.76
129.69
128.71
128.54
128.48
127.59
123.47
119.52
77.46
77.14
76.82
63.39
21.06
16.22
Cl
S
SPh
O
N
H
3e
f1 (ppm)

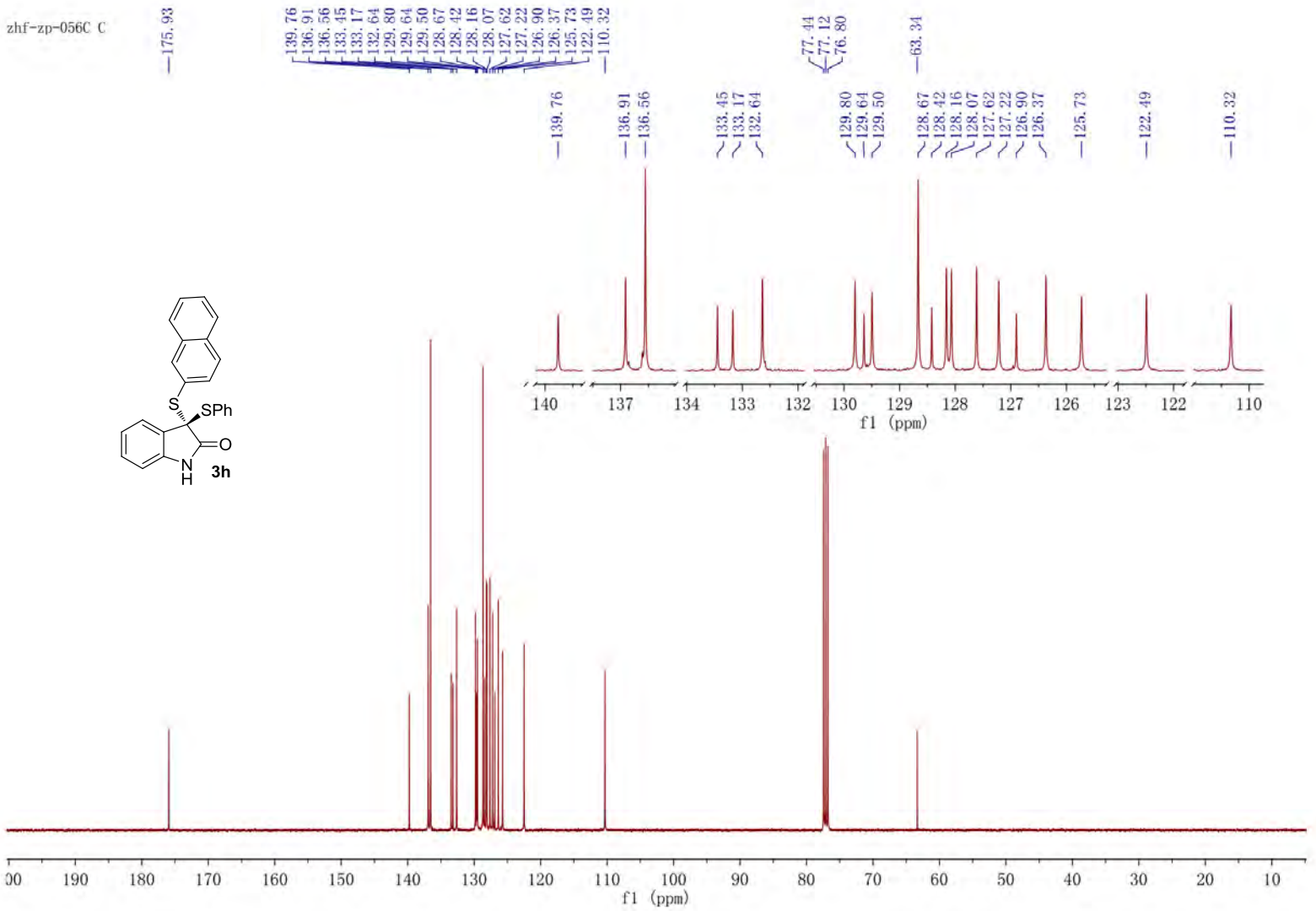

ZHF-ZQ-043
Me
S
SPh
O
N
H
3f
f1 (ppm)


zhf-zq-043 C
176.13
140.14
139.83
136.71
136.43
129.79
129.68
129.47
129.34
128.61
128.53
125.71
122.39
110.30
77.44
77.12
76.80
63.28
21.34
Me
S
SPh
O
N
H
3f
f1 (ppm)


zhf-zq-053 H
8.621
7.523
7.518
7.504
7.500
7.485
7.481
7.375
7.358
7.354
7.310
7.305
7.303
7.297
7.289
7.284
7.279
7.274
7.265
7.259
7.186
7.166
7.148
7.117
7.113
7.098
7.094
7.079
7.075
7.017
7.014
6.998
6.995
6.979
6.976
6.949
6.944
6.941
6.931
6.922
6.901
6.896
6.877
6.875
6.858
6.856
6.666
6.647
1.680
0.000
F
S
SPh
O
N
H
3g
1.05
2.05
2.86
2.11
1.12
1.10
3.09
1.03
f1 (ppm)


zhf-zq-053 C
175.32
164.78
162.30
139.57
138.93
136.60
132.40
132.32
129.83
129.59
129.53
128.63
127.83
125.81
124.21
124.17
122.42
116.85
115.90
77.34
77.22
77.02
76.70
63.01
109.89
F
S
SPh
O
N
H
3g
f1 (ppm)


7.886
7.753
7.733
7.718
7.670
7.650
7.619
7.598
7.469
7.450
7.445
7.441
7.424
7.401
7.397
7.382
7.379
7.290
7.285
7.274
7.271
7.180
7.161
7.082
7.063
7.047
6.941
6.922
6.905
6.519
6.501
6.498
1.590
0.000
1.01
2.01
1.03
1.06
2.01
3.01
1.07
2.03
2.00
1.03
1.02
f1 (ppm)
S
SPh
O
N
H
3h


zhf-zp-056C C
175.93
139.76
136.91
136.56
133.45
133.17
132.64
129.80
129.64
129.50
128.67
128.42
128.16
128.07
127.62
127.22
126.90
126.37
125.73
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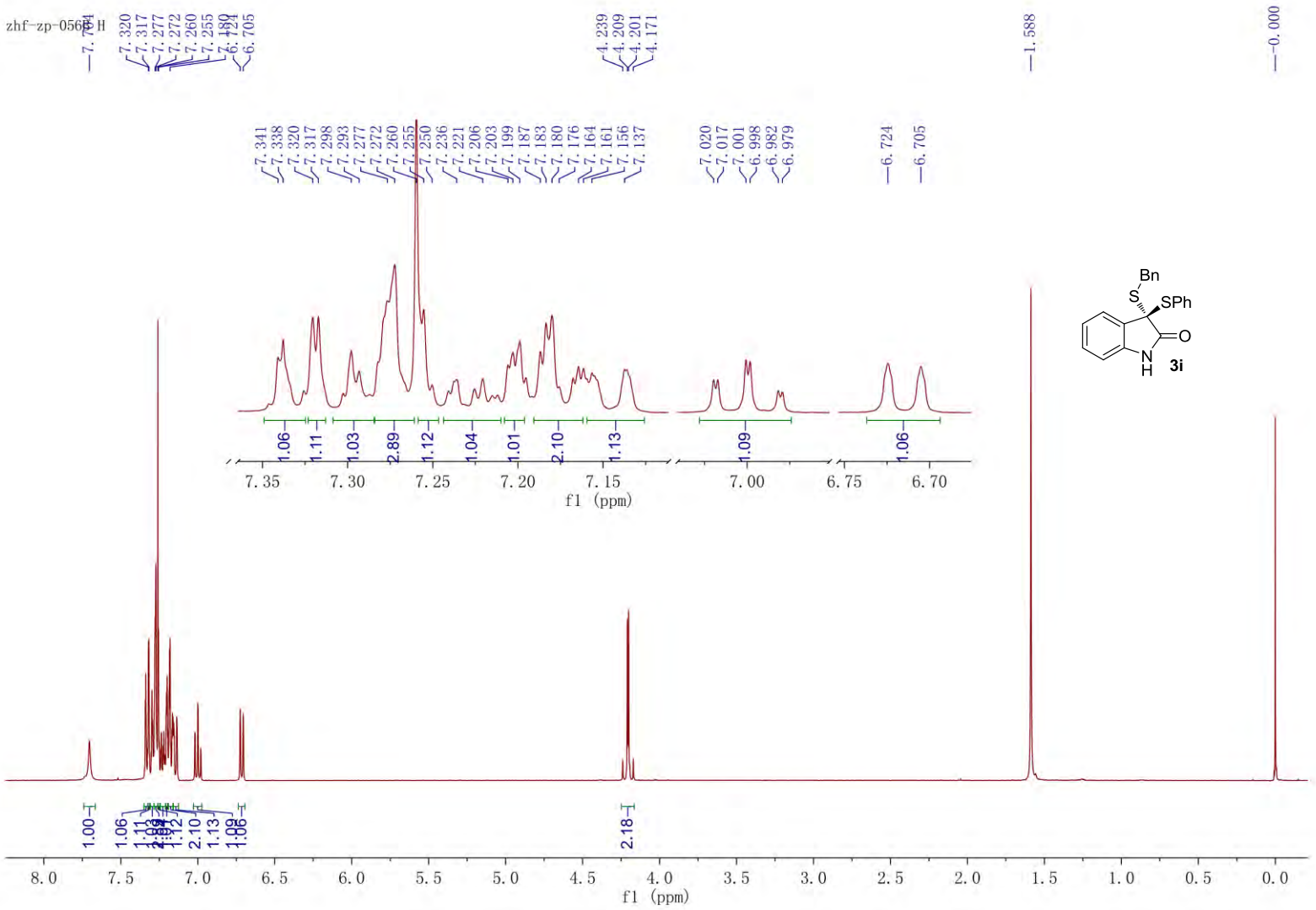
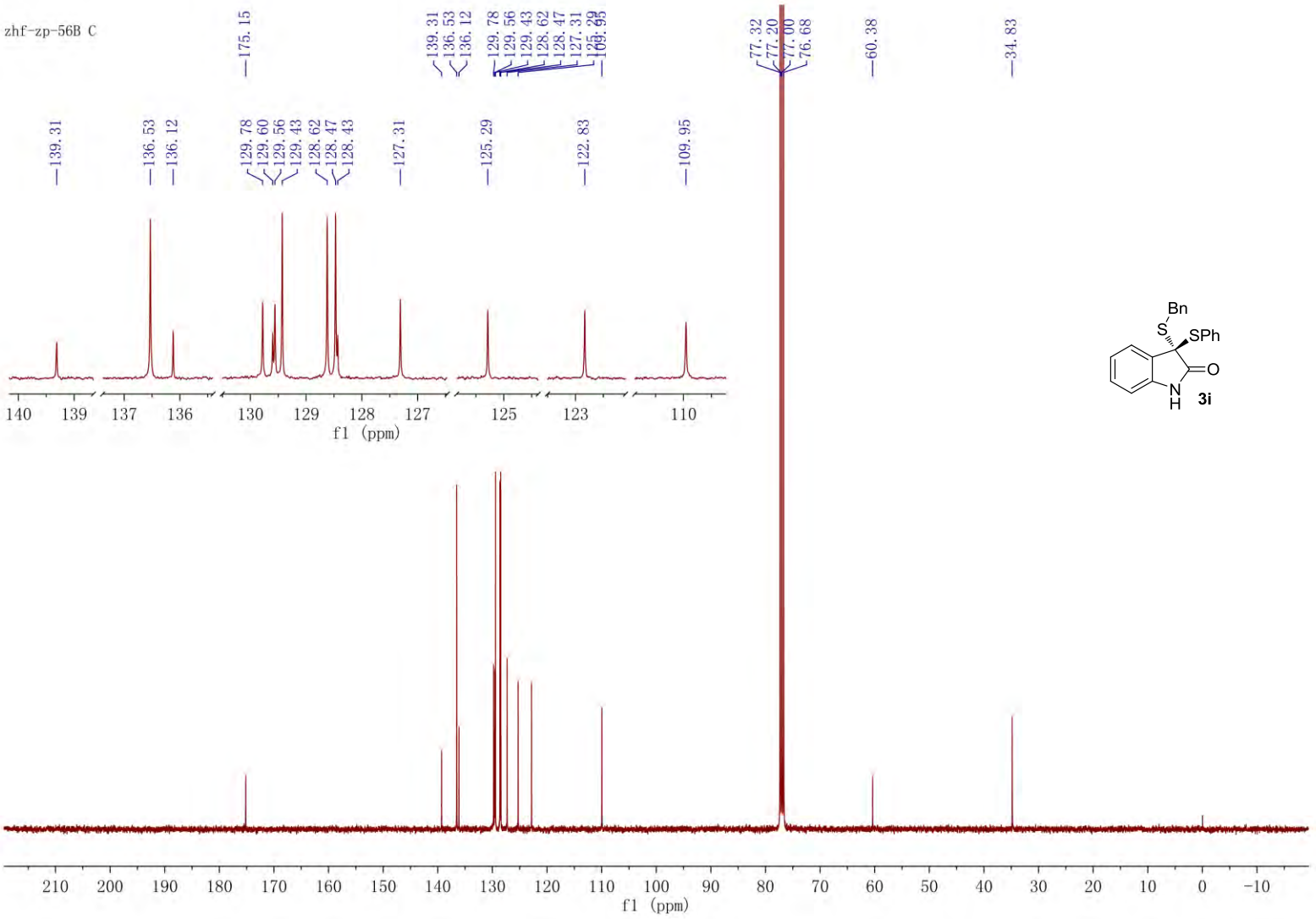
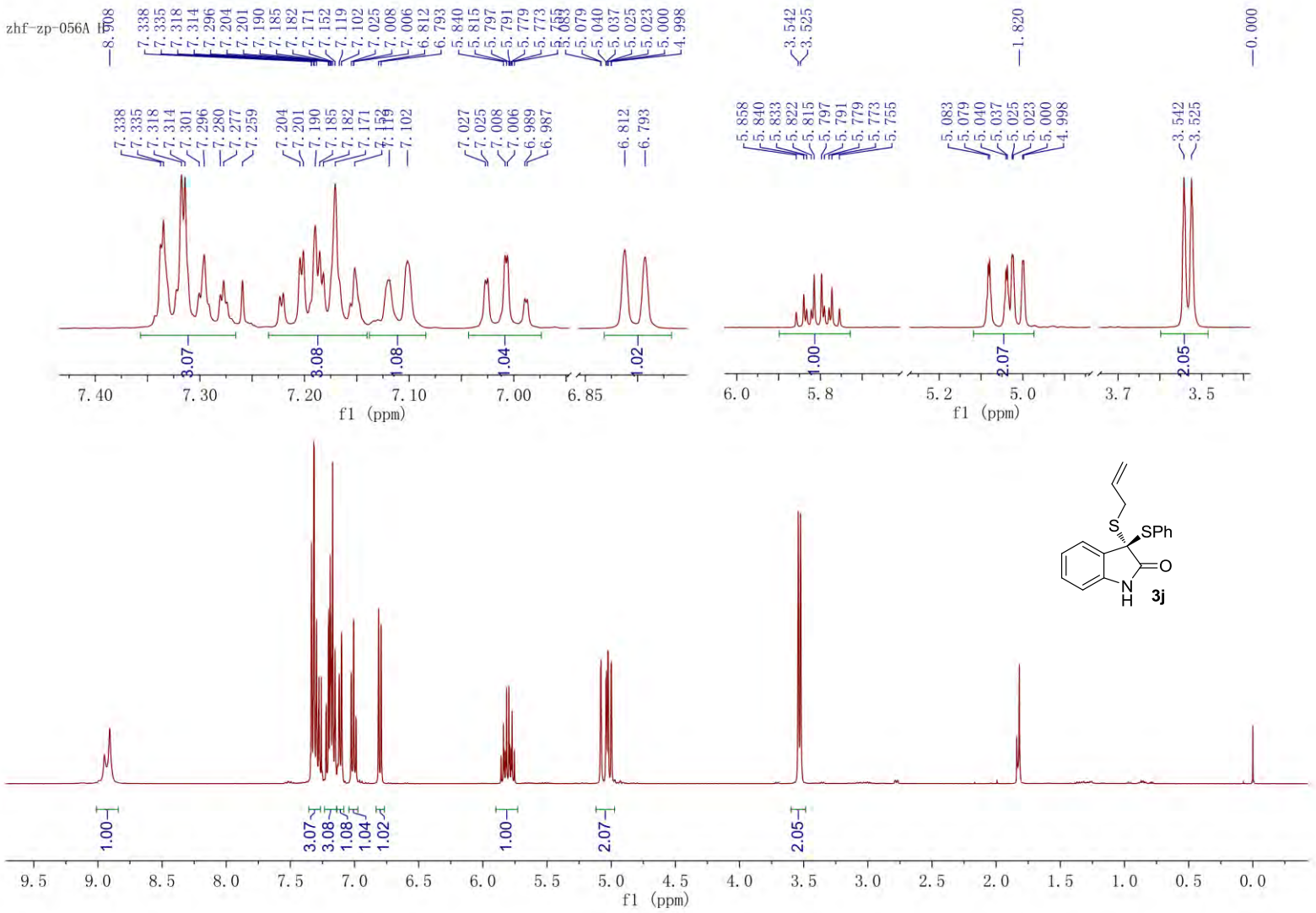
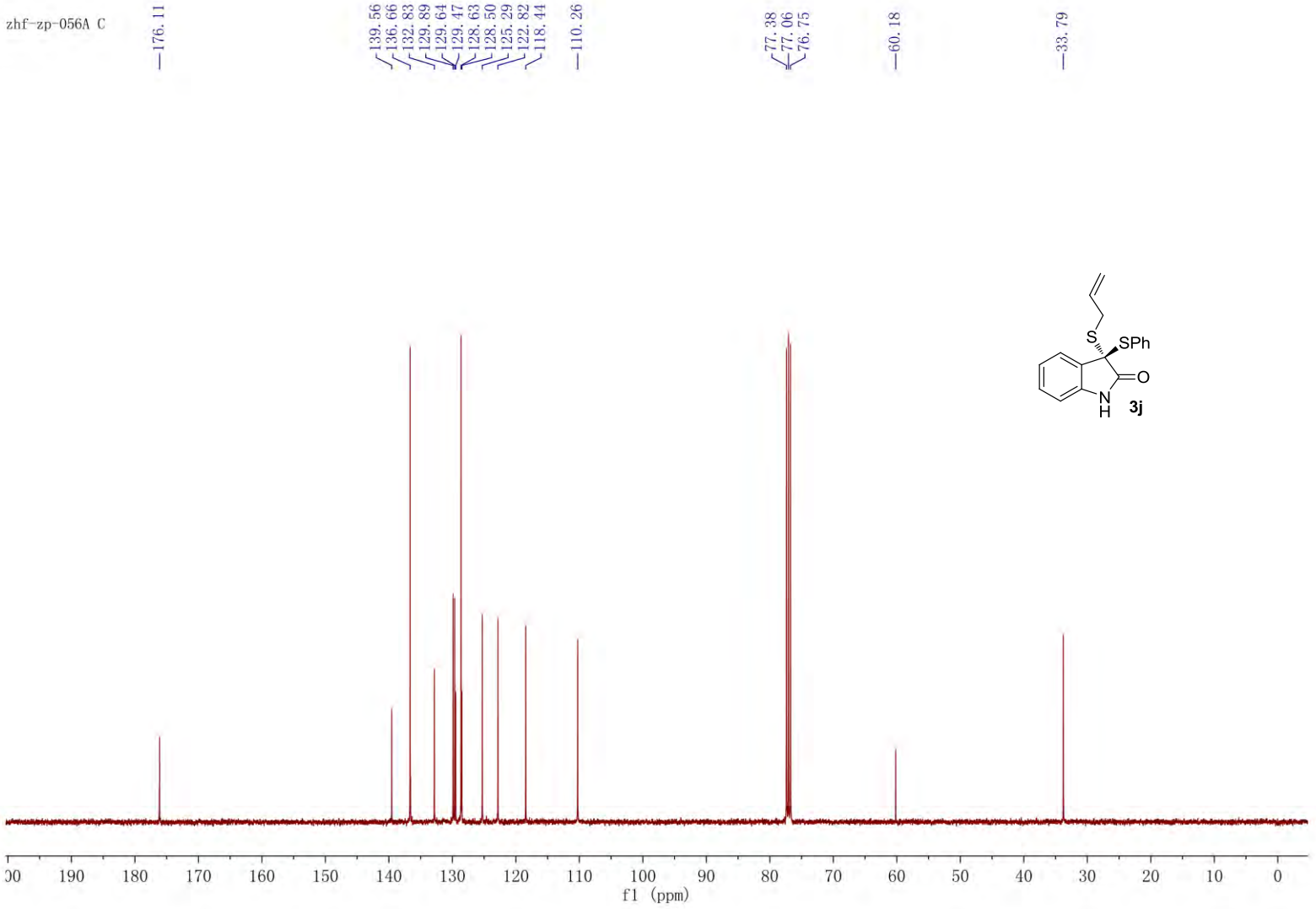
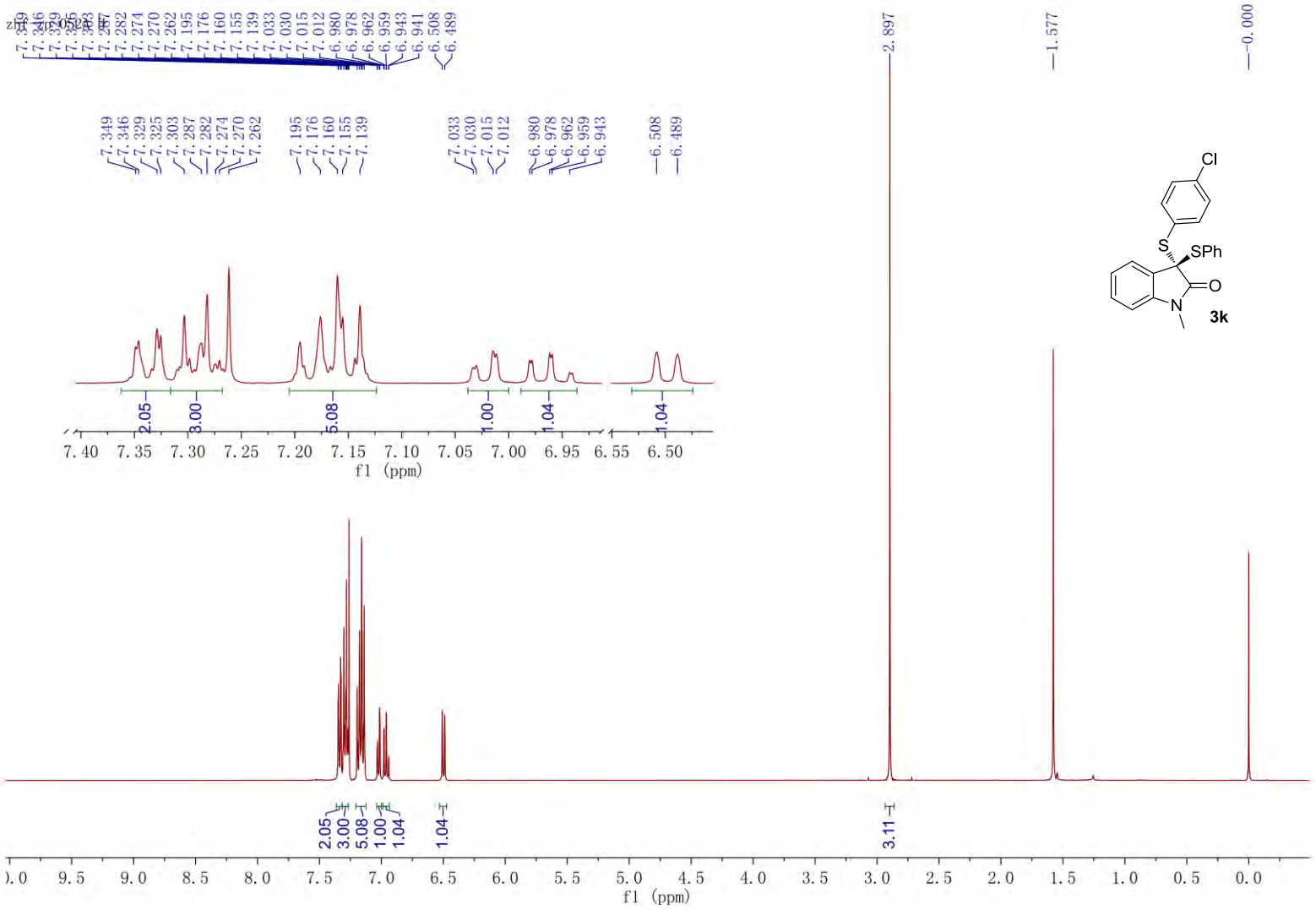
76.80
63.34
SPh
O
N
H
3h
f1 (ppm)

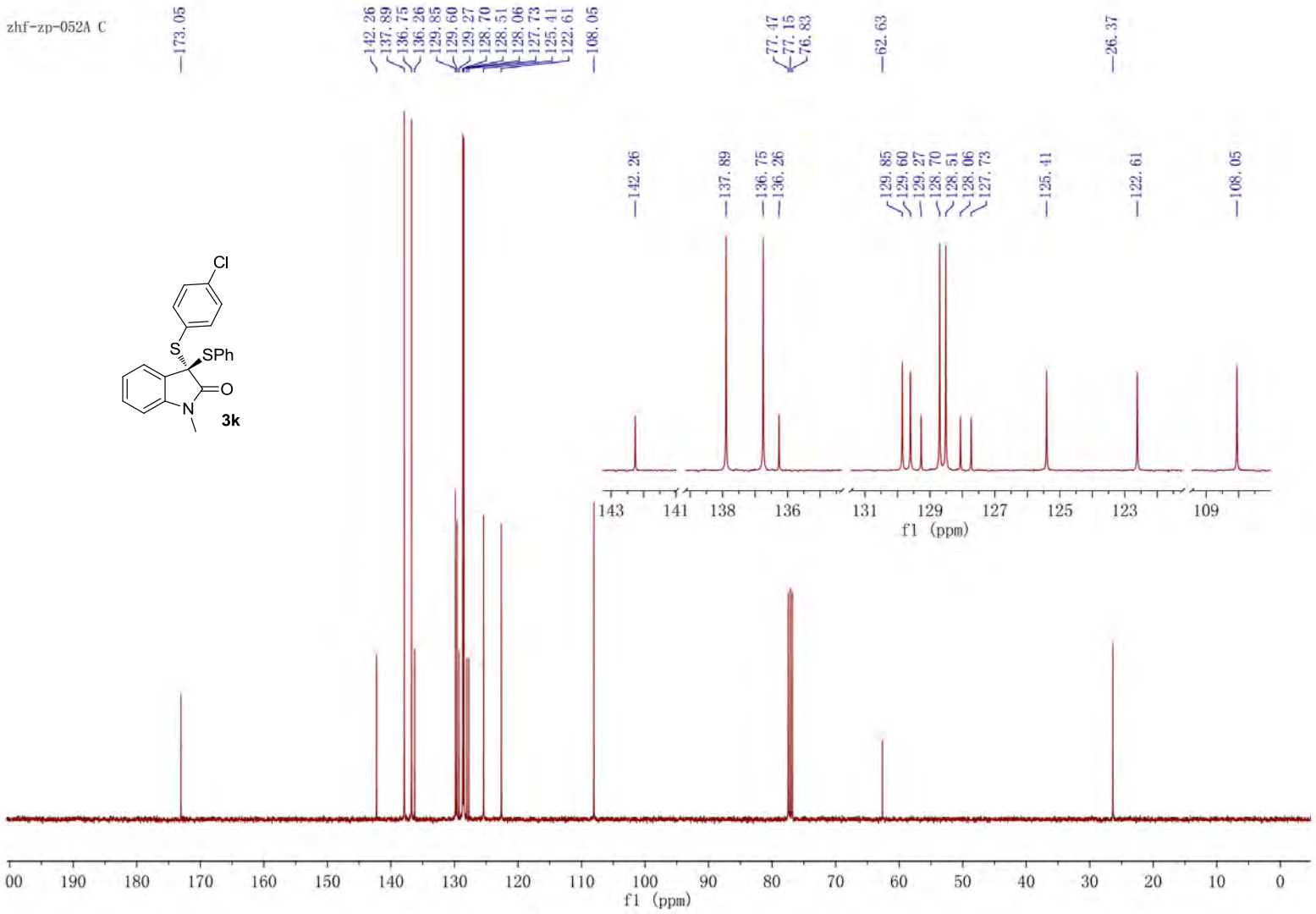

zhf-zp-0566-1H
7.704
7.320
7.317
7.277
7.272
7.260
7.255
7.180
6.724
6.705
4.239
4.209
4.201
4.171
1.588
0.000
7.341
7.338
7.320
7.317
7.298
7.293
7.277
7.272
7.260
7.255
7.250
7.236
7.221
7.206
7.203
7.199
7.187
7.183
7.180
7.176
7.164
7.161
7.156
7.137
7.020
7.017
7.001
6.998
6.982
6.979
6.724
6.705
1.06
1.11
1.03
2.89
1.12
1.04
1.01
2.10
1.13
1.09
1.06
7.35
7.30
7.25
7.20
7.15
7.00
6.75
6.70
f1 (ppm)
Bn
S
SPh
O
N
H
3i
1.00
1.06
1.11
2.10
1.13
1.06
2.18
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

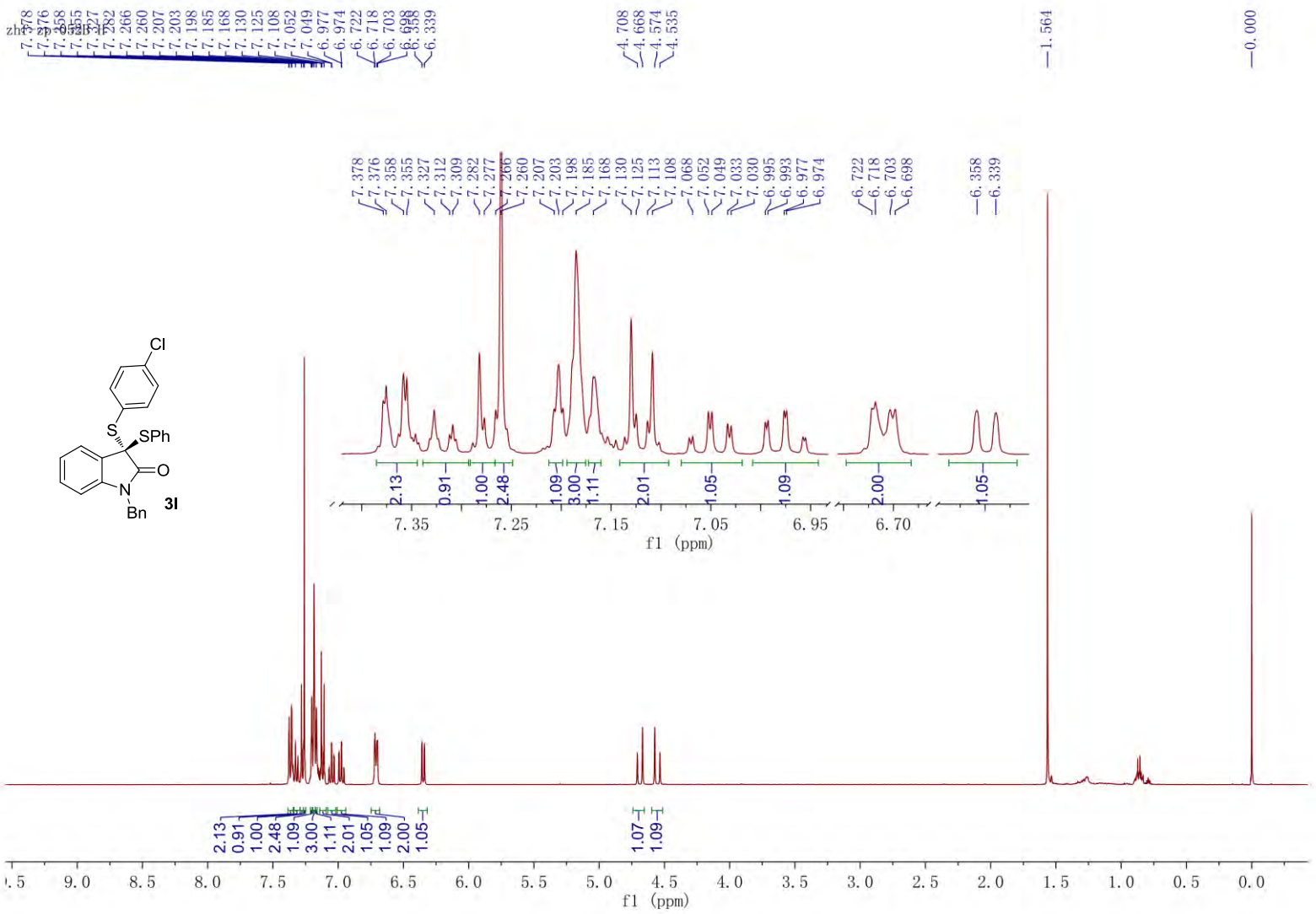

zhf-zp-56B C
175.15
139.31
136.53
136.12
129.78
129.56
129.43
128.62
128.47
127.31
125.29
122.83
109.95
77.32
77.20
77.00
76.68
60.38
34.83
f1 (ppm)
Bn
S
SPh
O
N
H
3i

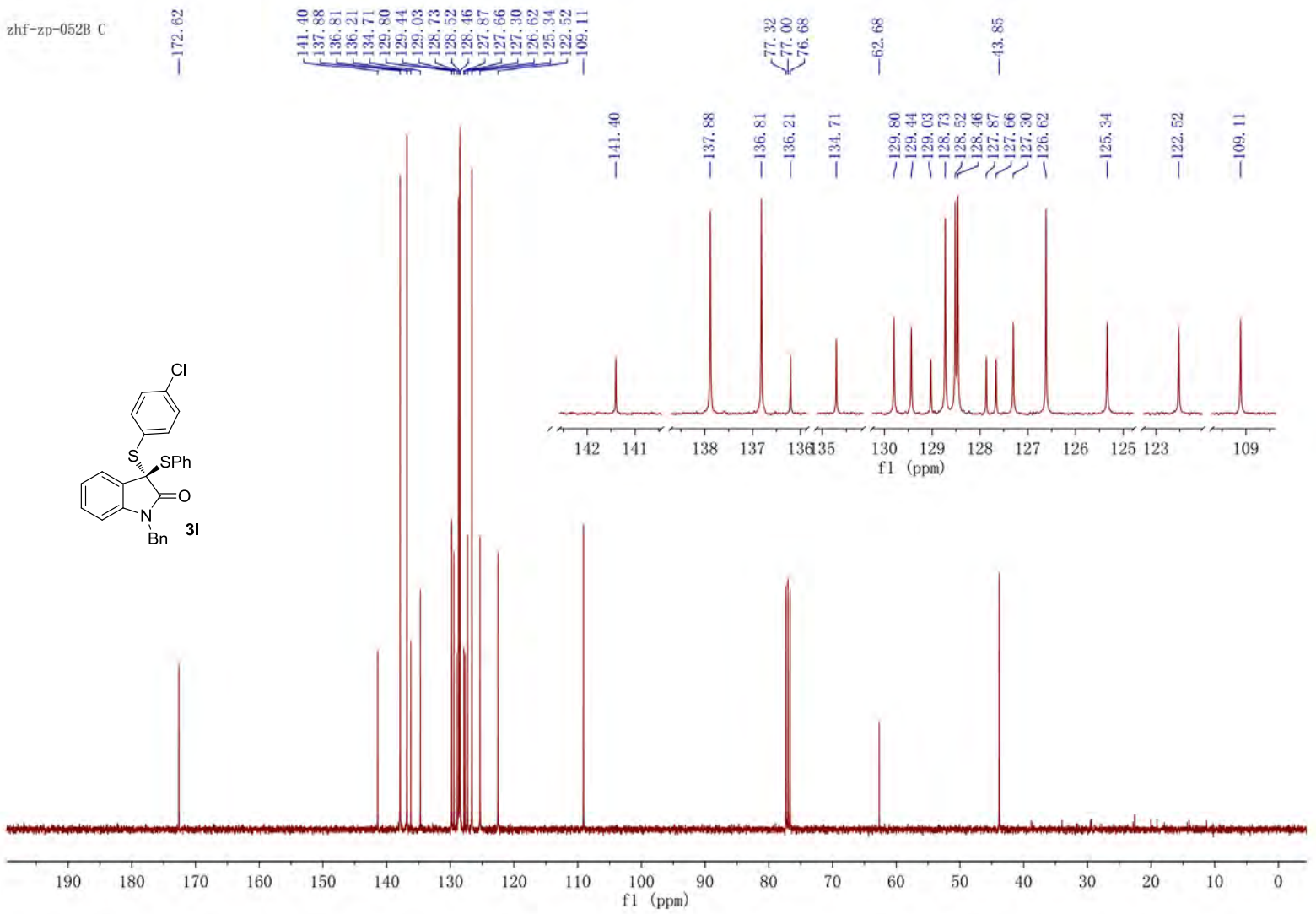

zhf-zp-056A H
f1 (ppm)
SPh
O
N
H
3j

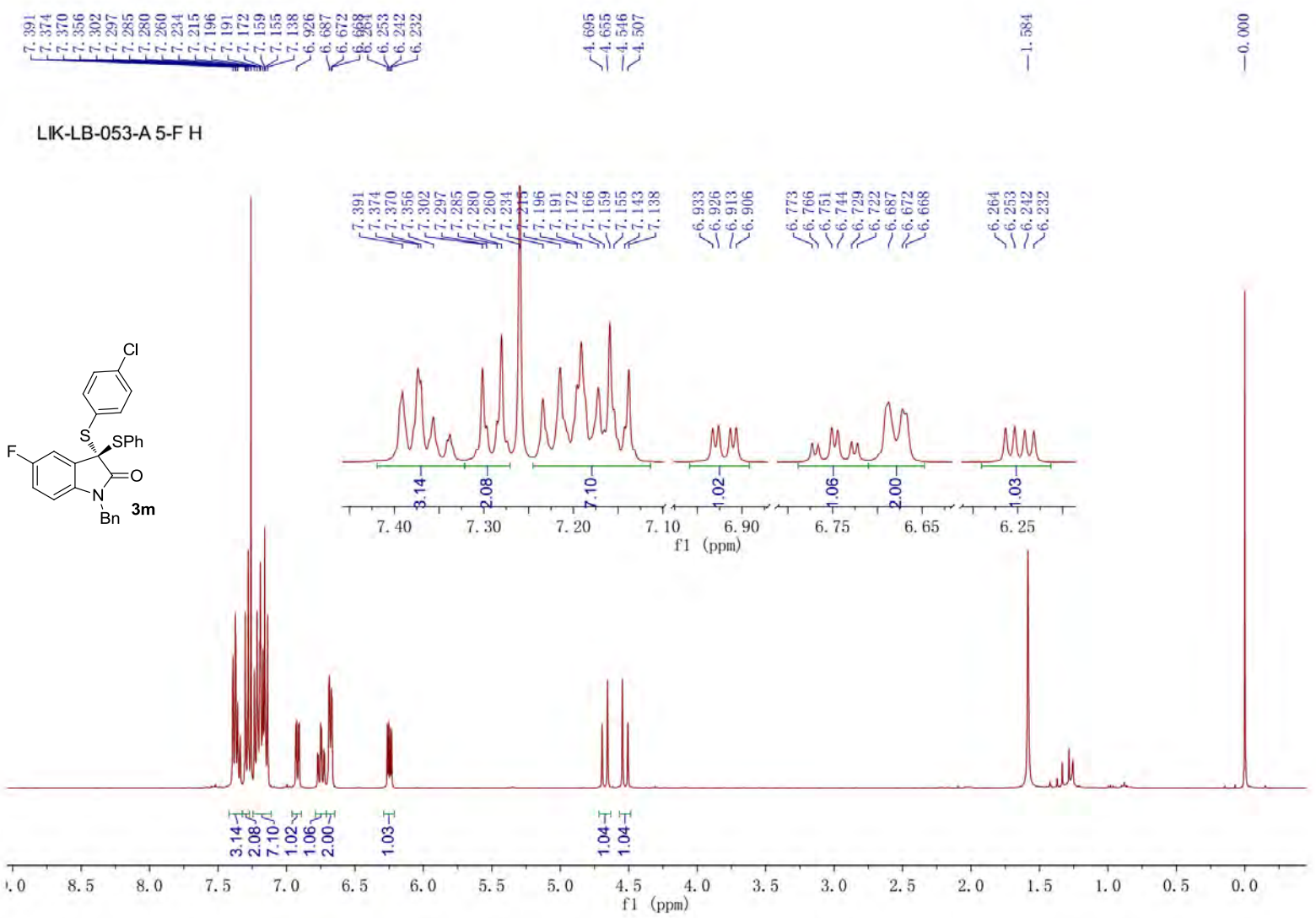

zhf-zp-056A C
176.11
139.56
136.66
132.83
129.89
129.64
129.47
128.63
128.50
125.29
122.82
118.44
110.26
77.38
77.06
76.75
60.18
33.79
S
SPh
O
N
H
3j
f1 (ppm)

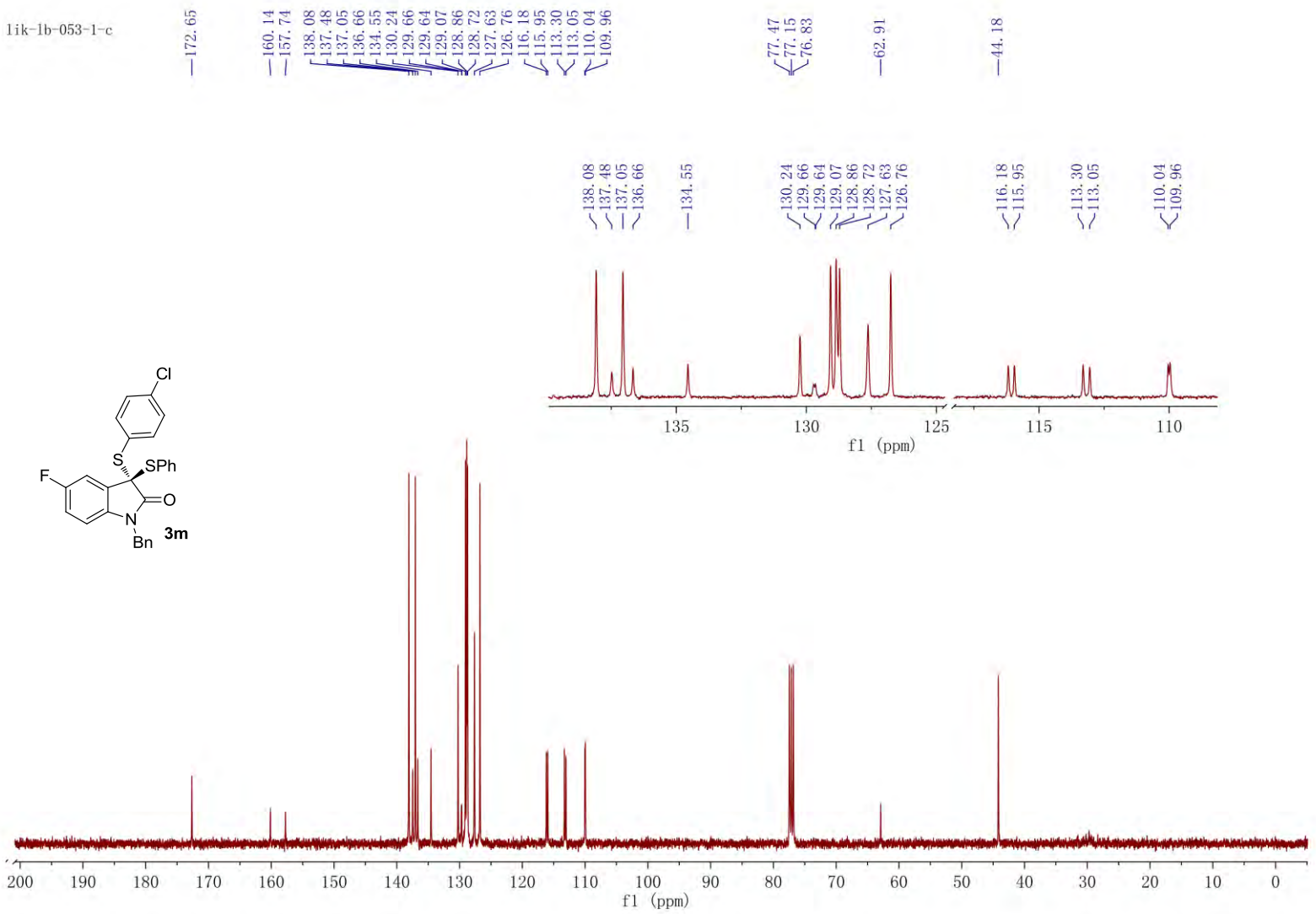

7.349
7.346
7.329
7.325
7.303
7.287
7.282
7.274
7.270
7.262
7.195
7.176
7.160
7.155
7.139
7.033
7.030
7.015
7.012
6.980
6.978
6.962
6.959
6.943
6.508
6.489
2.897
1.577
0.000
2.05
3.00
5.08
1.00
1.04
1.04
3.11
f1 (ppm)
Cl
S
SPh
O
N
3k

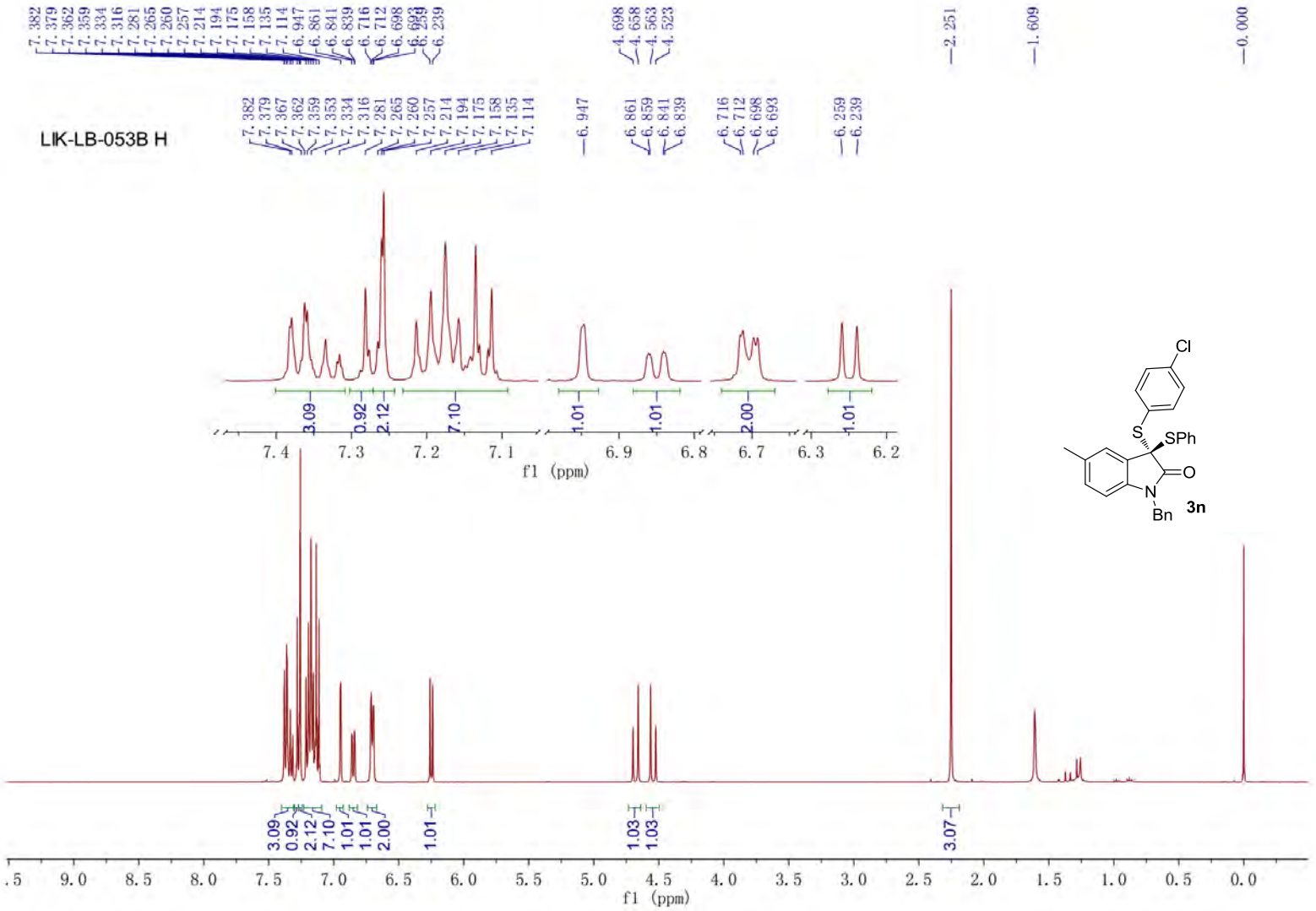

zhf-zp-052A C
173.05
142.26
137.89
136.75
136.26
129.85
129.60
129.27
128.70
128.51
128.06
127.73
125.41
122.61
108.05
77.47
77.15
76.83
62.63
26.37
Cl
S
SPh
O
N
3k
f1 (ppm)

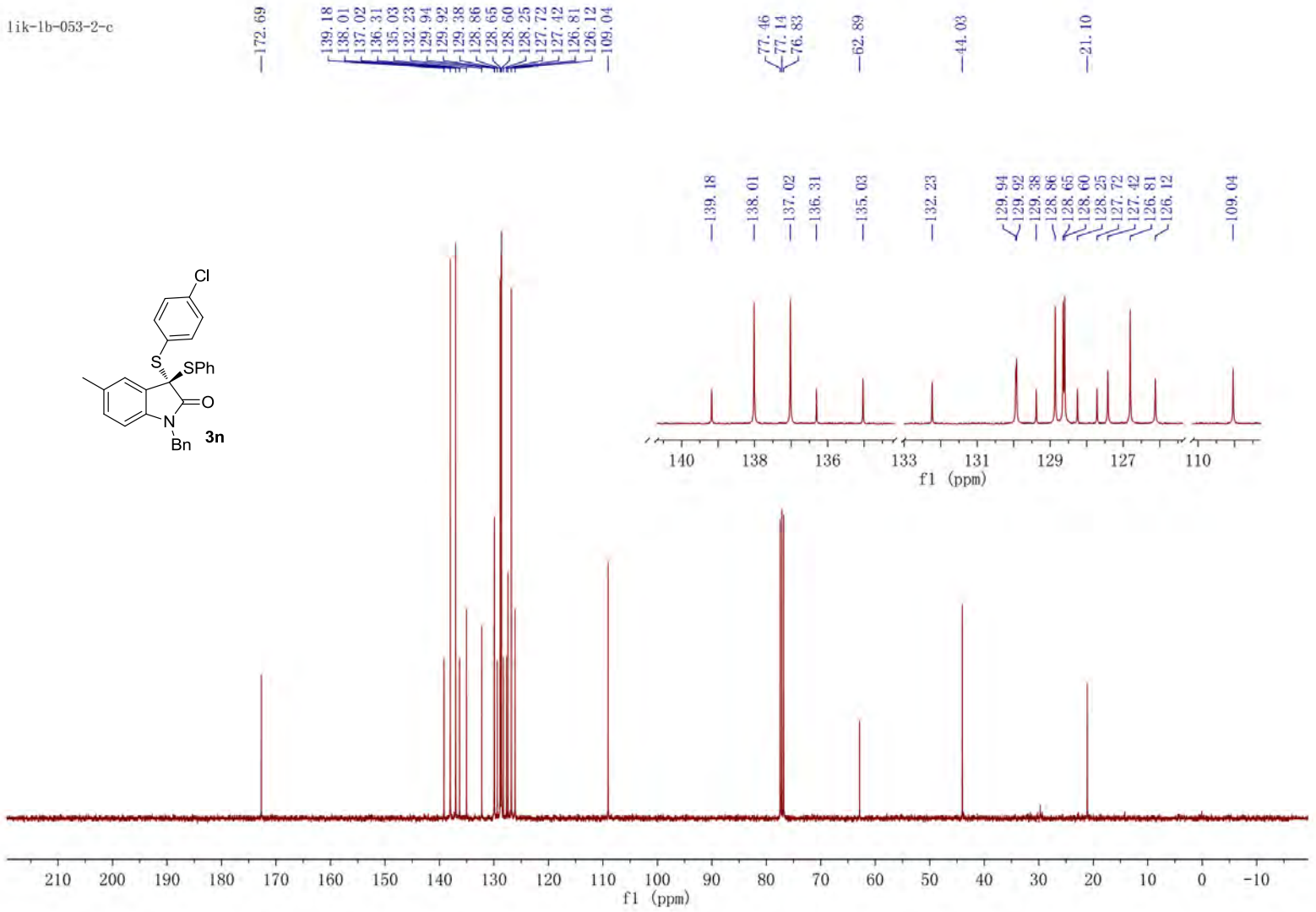

Cl
S
SPh
O
N
Bn
3l
f1 (ppm)

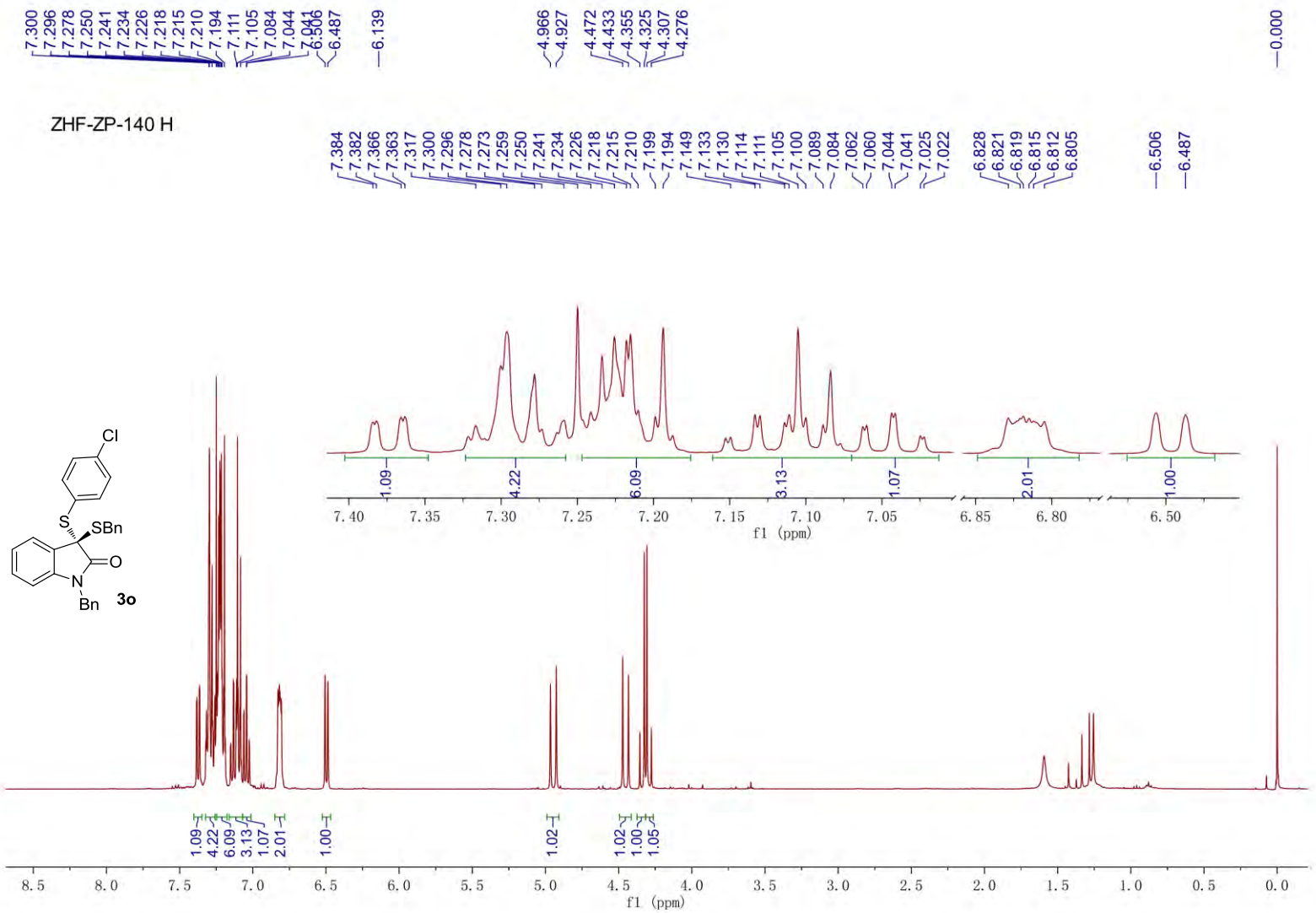

zhf-zp-052B C
172.62
141.40
137.88
136.81
136.21
134.71
129.80
129.44
129.03
128.73
128.52
128.46
127.87
127.66
127.30
126.62
125.34
122.52
109.11
77.32
77.00
76.68
62.68
43.85
Cl
S
SPh
O
N
Bn
3l
f1 (ppm)

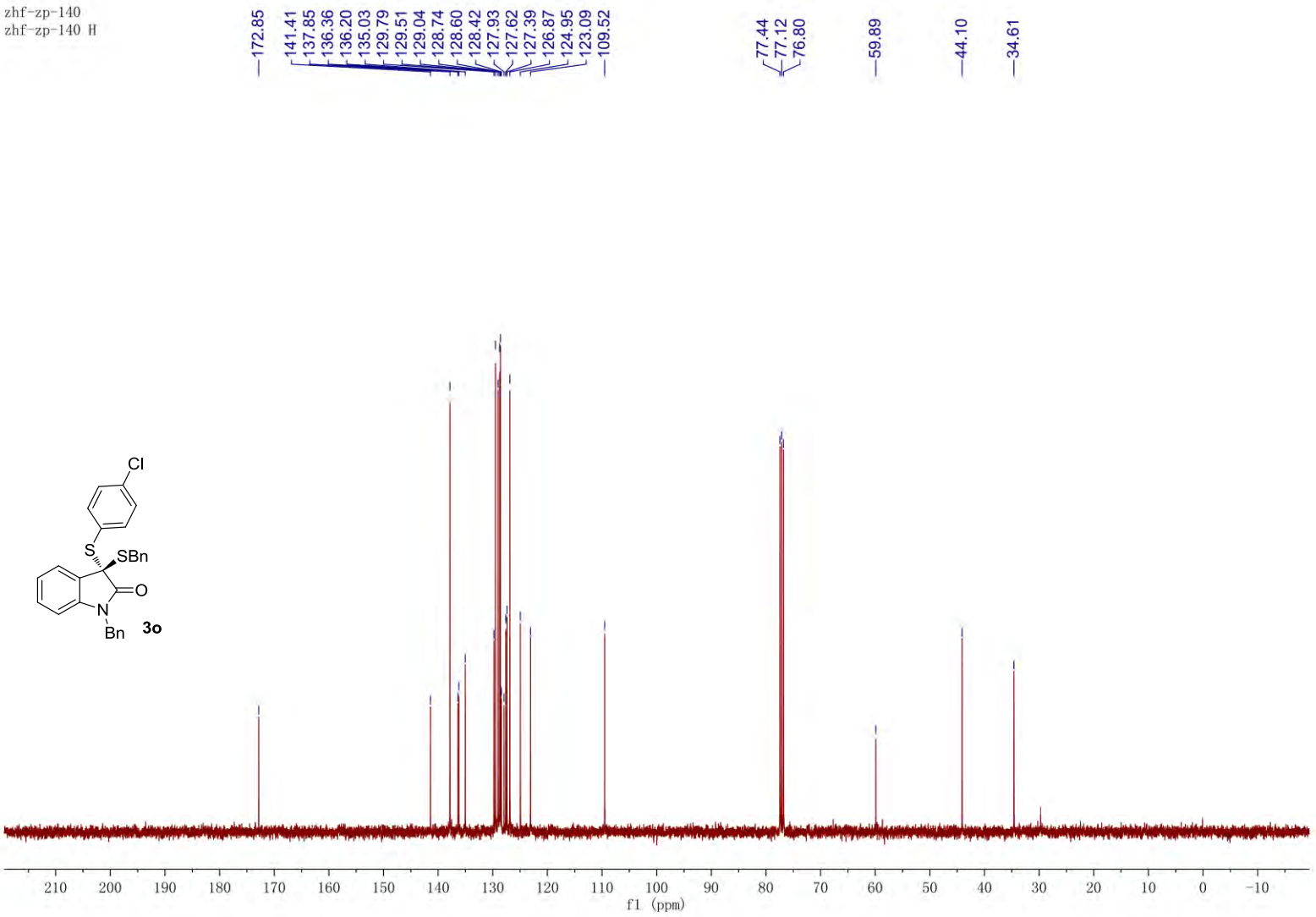

LIK-LB-053-A 5-F H
Cl
S
SPh
F
O
N
Bn
3m
f1 (ppm)

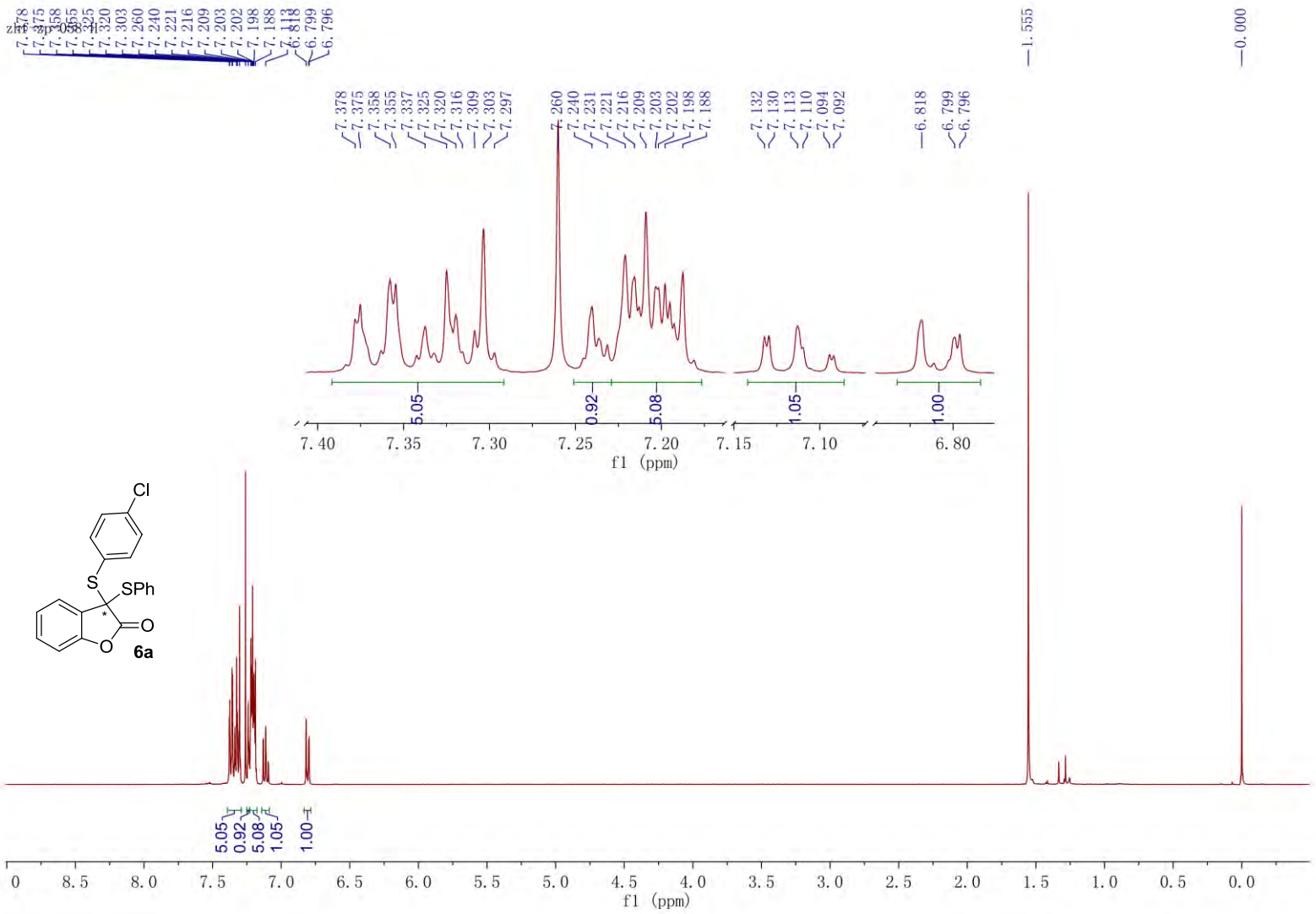

1ik-1b-053-1-c
172.65
160.14
157.74
138.08
137.48
137.05
136.66
134.55
130.24
129.66
129.64
129.07
128.86
128.72
127.63
126.76
116.18
115.95
113.30
113.05
110.04
109.96
77.47
77.15
76.83
62.91
44.18
Cl
S
SPh
F
O
N
Bn
3m
f1 (ppm)

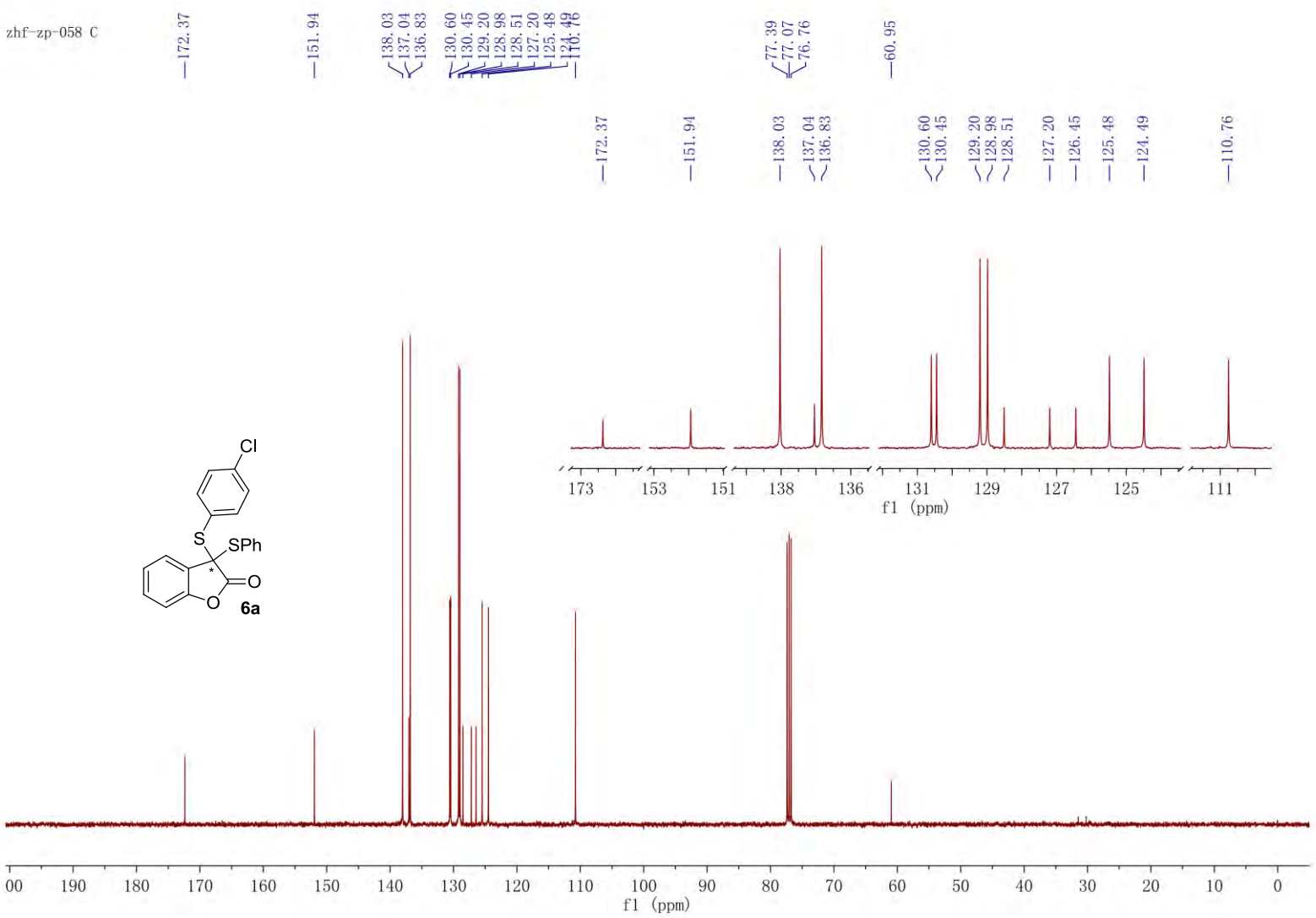

LIK-LB-053B H
f1 (ppm)
Cl
S
SPh
O
N
Bn
3n

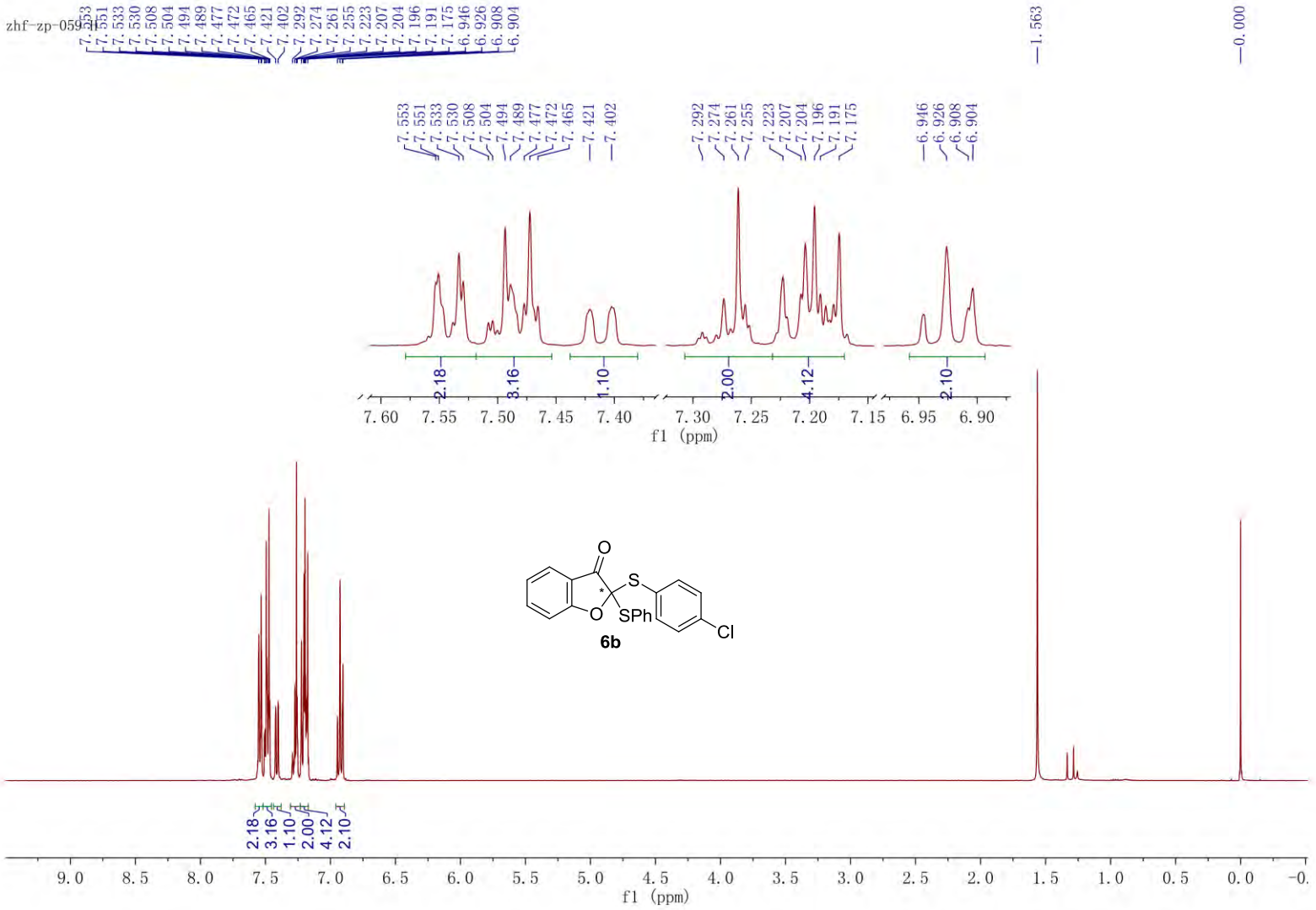

1ik-1b-053-2-c
172.69
139.18
138.01
137.02
136.31
135.03
132.23
129.94
129.92
129.38
128.86
128.65
128.60
128.25
127.72
127.42
126.81
126.12
109.04
77.46
77.14
76.83
62.89
44.03
21.10
Cl
S
SPh
O
N
Bn
3n
f1 (ppm)

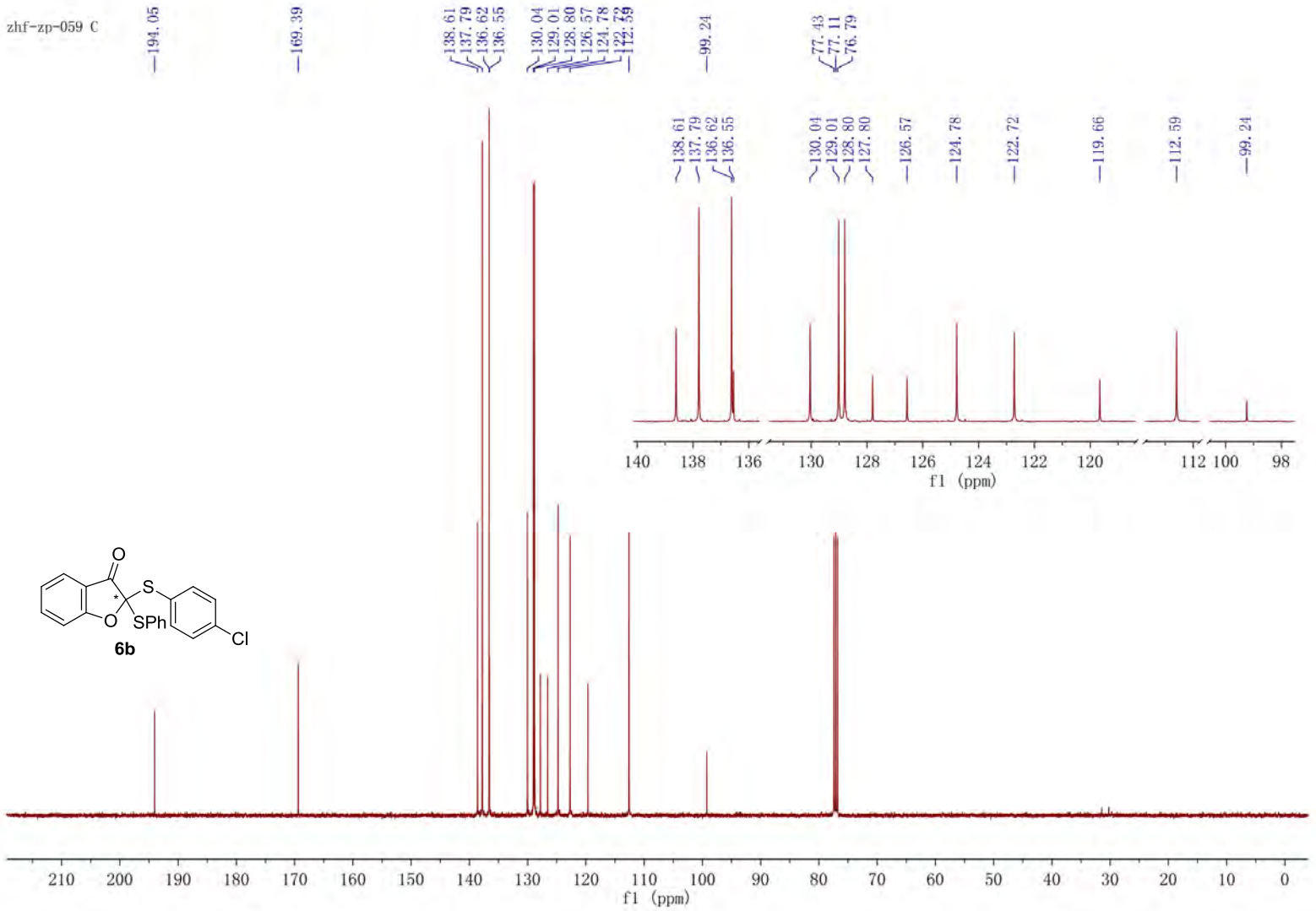

ZHF-ZP-140 H
7.300
7.296
7.278
7.250
7.241
7.234
7.226
7.218
7.215
7.210
7.194
7.111
7.105
7.084
7.044
7.041
6.506
6.487
6.139
4.966
4.927
4.472
4.433
4.355
4.325
4.307
4.276
0.000
7.384
7.382
7.366
7.363
7.317
7.300
7.296
7.278
7.273
7.259
7.250
7.241
7.234
7.226
7.218
7.215
7.210
7.199
7.194
7.149
7.133
7.130
7.114
7.111
7.105
7.100
7.089
7.084
7.062
7.060
7.044
7.041
7.025
7.022
6.828
6.821
6.819
6.815
6.812
6.805
6.506
6.487
Cl
S
SBn
O
N
Bn
3o
1.09
4.22
6.09
3.13
1.07
2.01
1.00
1.02
1.02
1.00
1.05
f1 (ppm)

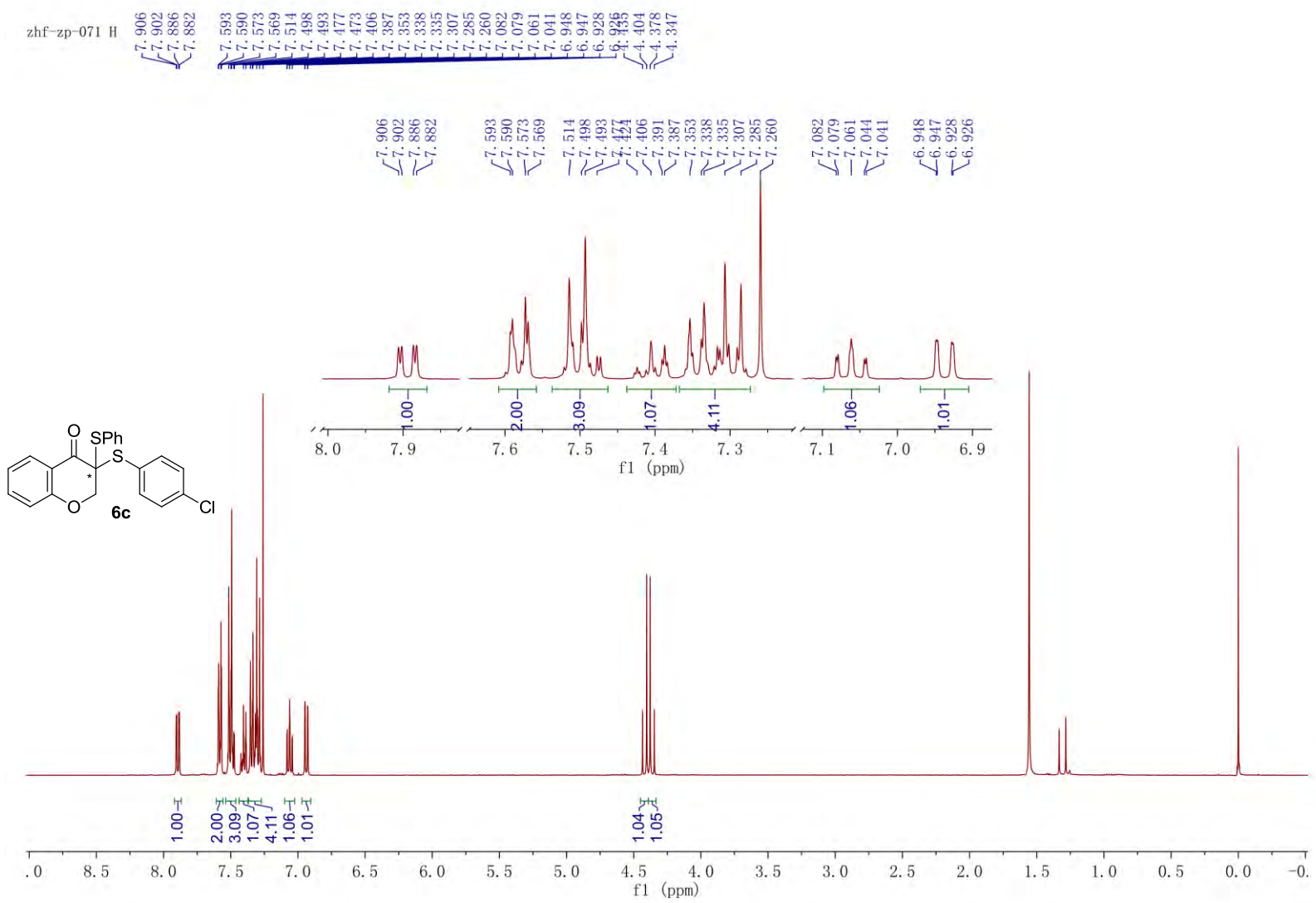

zhf-zp-140
zhf-zp-140 H
172.85
141.41
137.85
136.36
136.20
135.03
129.79
129.51
129.04
128.74
128.60
128.42
127.93
127.62
127.39
126.87
124.95
123.09
109.52
77.44
77.12
76.80
59.89
44.10
34.61
Cl
S
SBn
O
N
Bn
3o
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)

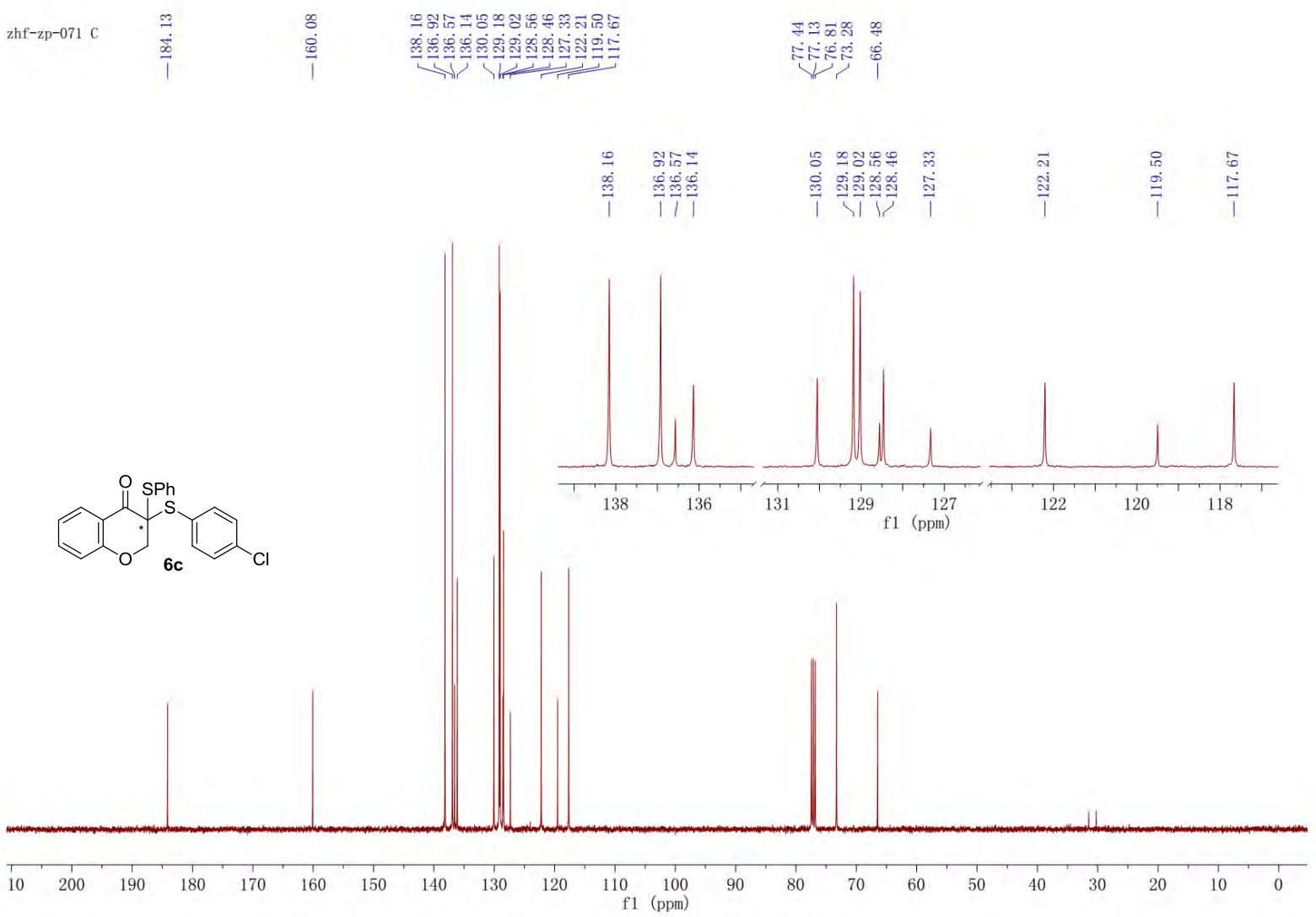

7.378
7.375
7.358
7.355
7.337
7.325
7.320
7.316
7.309
7.303
7.297
7.260
7.240
7.231
7.221
7.216
7.209
7.203
7.202
7.198
7.188
7.132
7.130
7.113
7.110
7.094
7.092
6.818
6.799
6.796
1.555
0.000
5.05
0.92
5.08
1.05
1.00
f1 (ppm)
Cl
S
SPh
O
O
6a

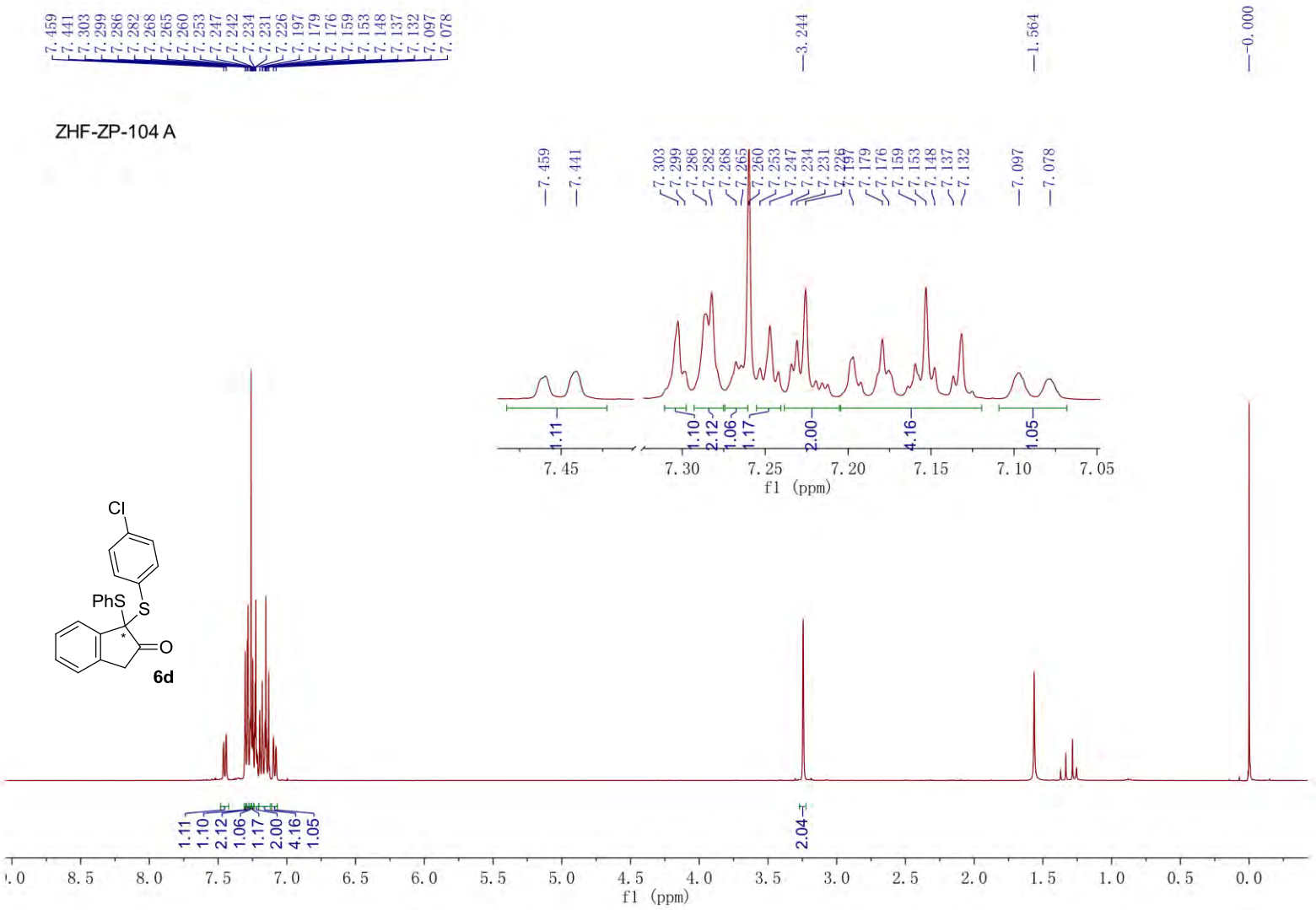

zhf-zp-058 C
172.37
151.94
138.03
137.04
136.83
130.60
130.45
129.20
128.98
128.51
127.20
125.48
124.49
110.76
77.39
77.07
76.76
60.95
Cl
S
SPh
O
O
6a
f1 (ppm)

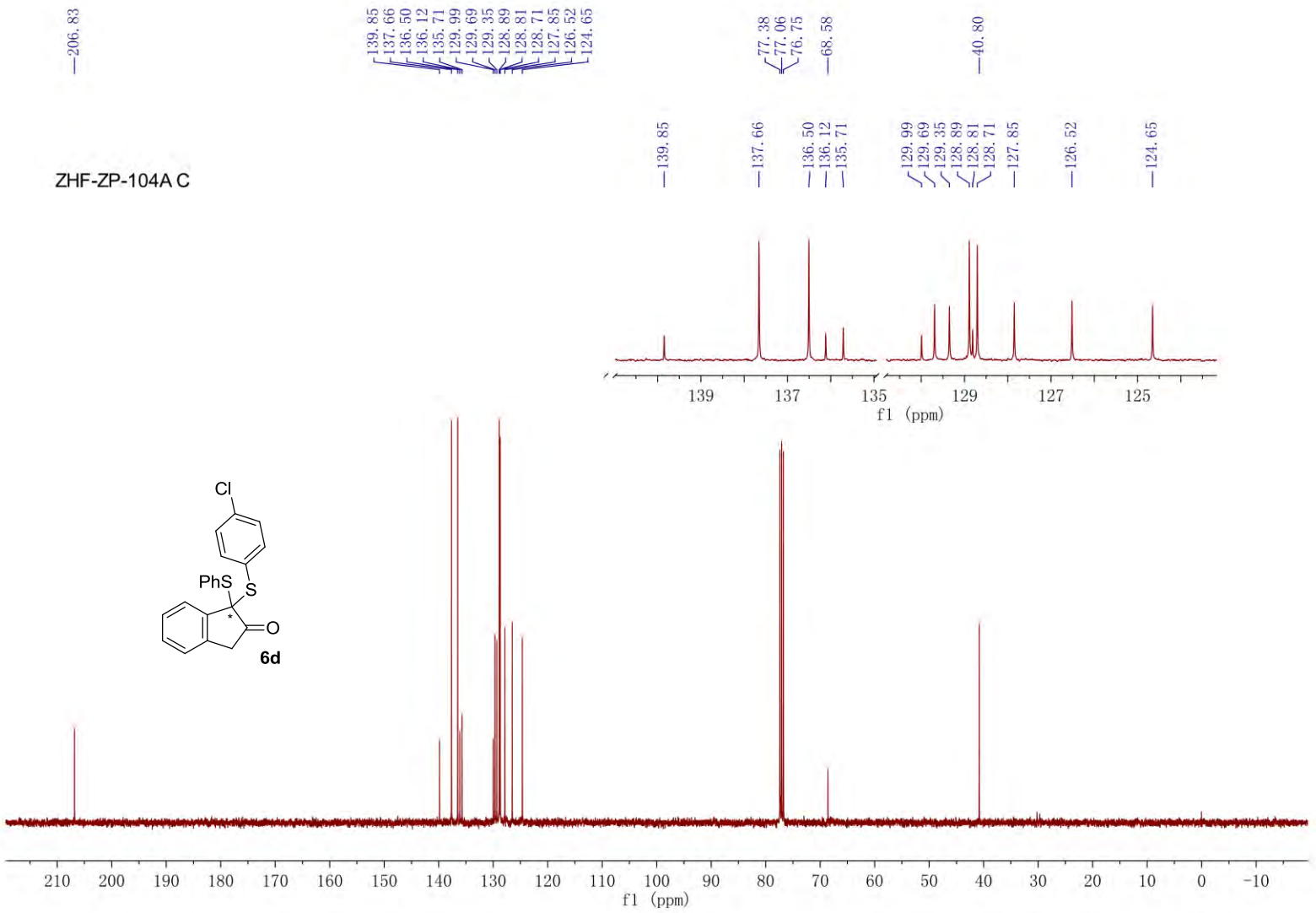

zhf-zp-059-2
7.553
7.551
7.533
7.530
7.508
7.504
7.494
7.489
7.477
7.472
7.465
7.421
7.402
7.292
7.274
7.261
7.255
7.223
7.207
7.204
7.196
7.191
7.175
6.946
6.926
6.908
6.904
1.563
0.000
2.18
3.16
1.10
2.00
4.12
2.10
f1 (ppm)
O
S
SPh
O
Cl
6b

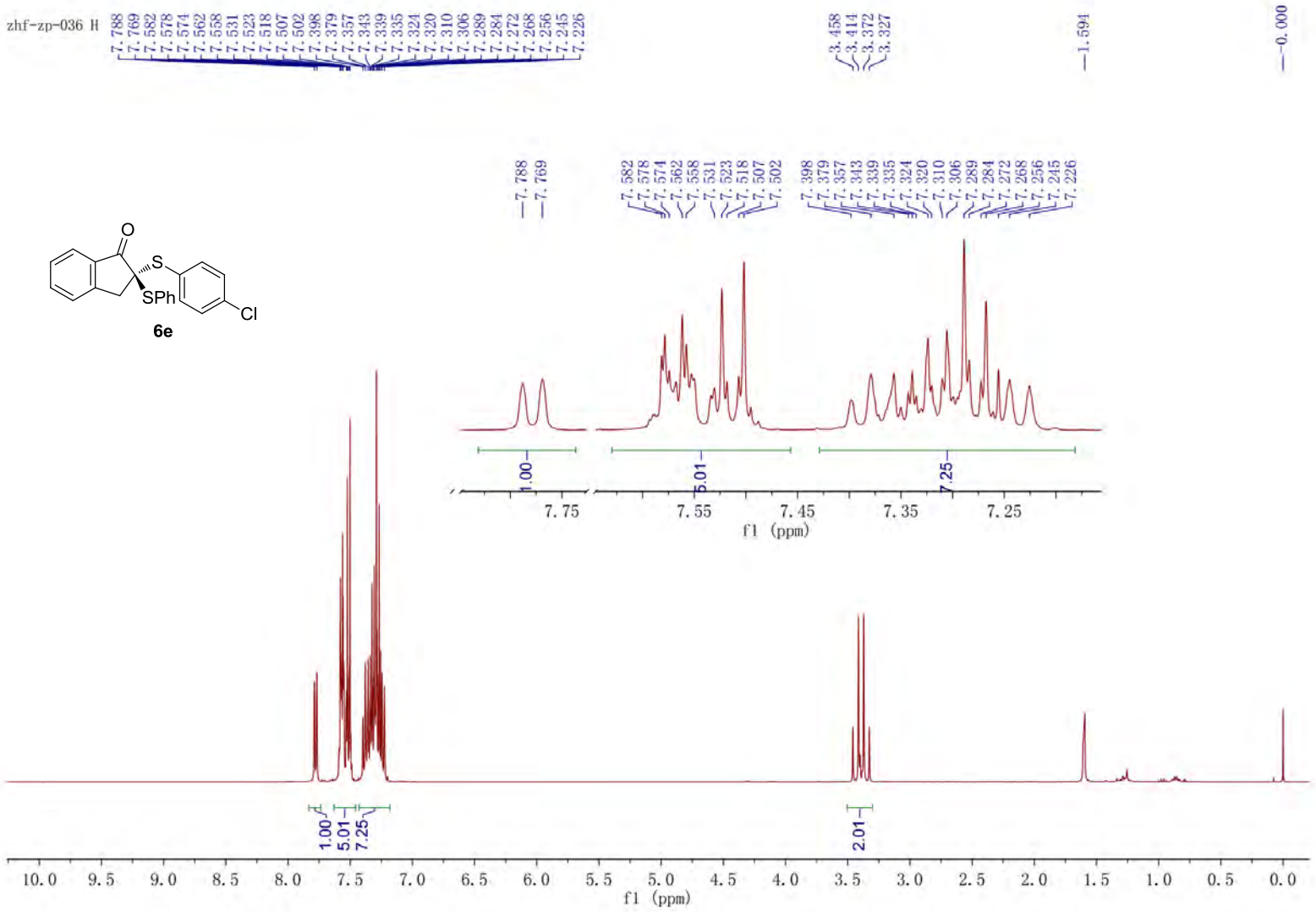

zhf-zp-059 C
194.05
169.39
138.61
137.79
136.62
136.55
130.04
129.01
128.80
126.57
124.78
122.72
112.59
99.24
77.43
77.11
76.79
119.66
127.80
O
S
SPh
Cl
6b
f1 (ppm)

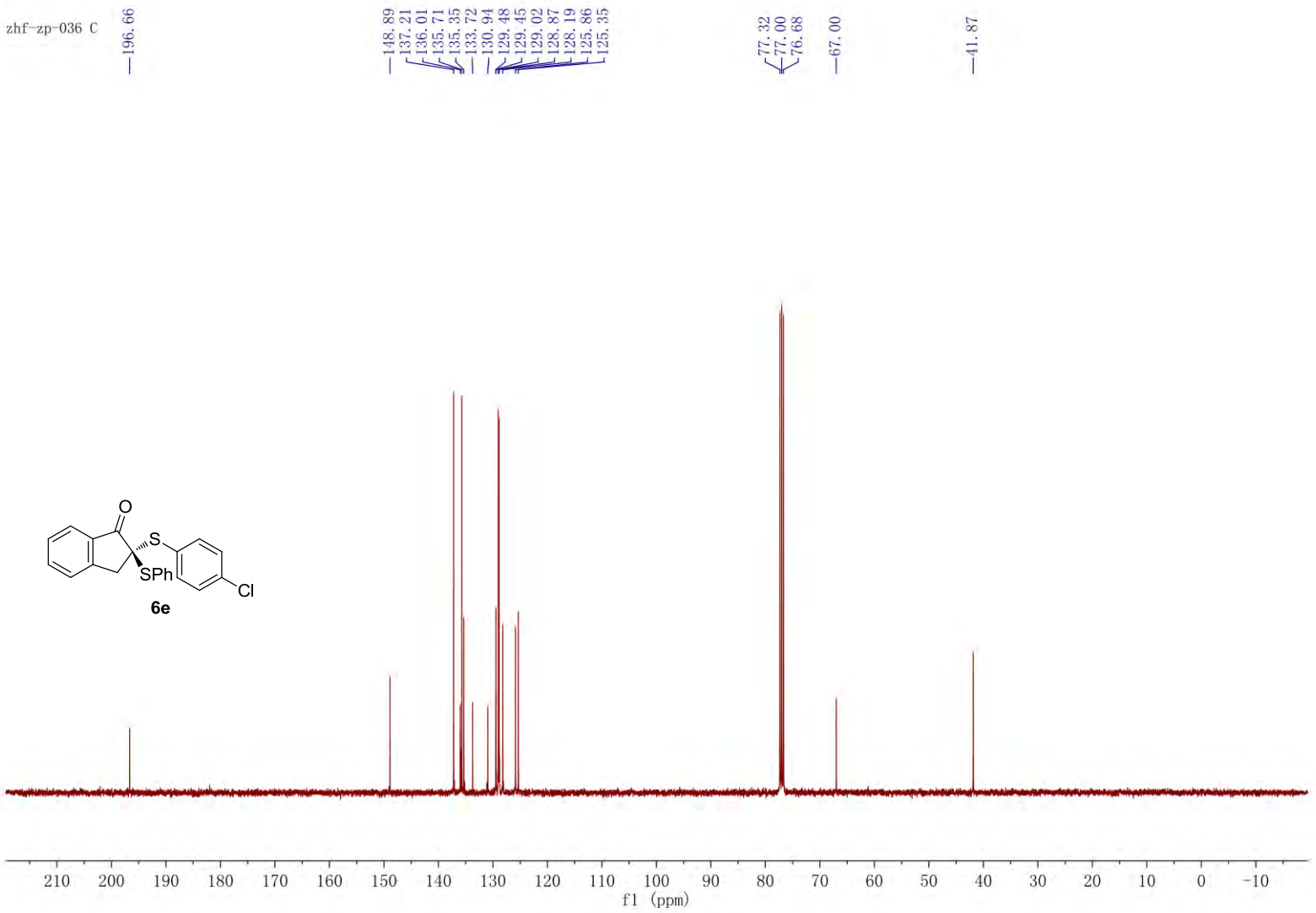

zhf-zp-071 H
7.906
7.902
7.886
7.882
7.593
7.590
7.573
7.569
7.514
7.498
7.493
7.477
7.473
7.406
7.387
7.353
7.338
7.335
7.307
7.285
7.260
7.082
7.079
7.061
7.041
6.948
6.947
6.928
6.926
4.404
4.378
4.347
1.00
2.00
3.09
1.07
4.11
1.06
1.01
1.04
1.05
f1 (ppm)
O
SPh
S
O
Cl
6c

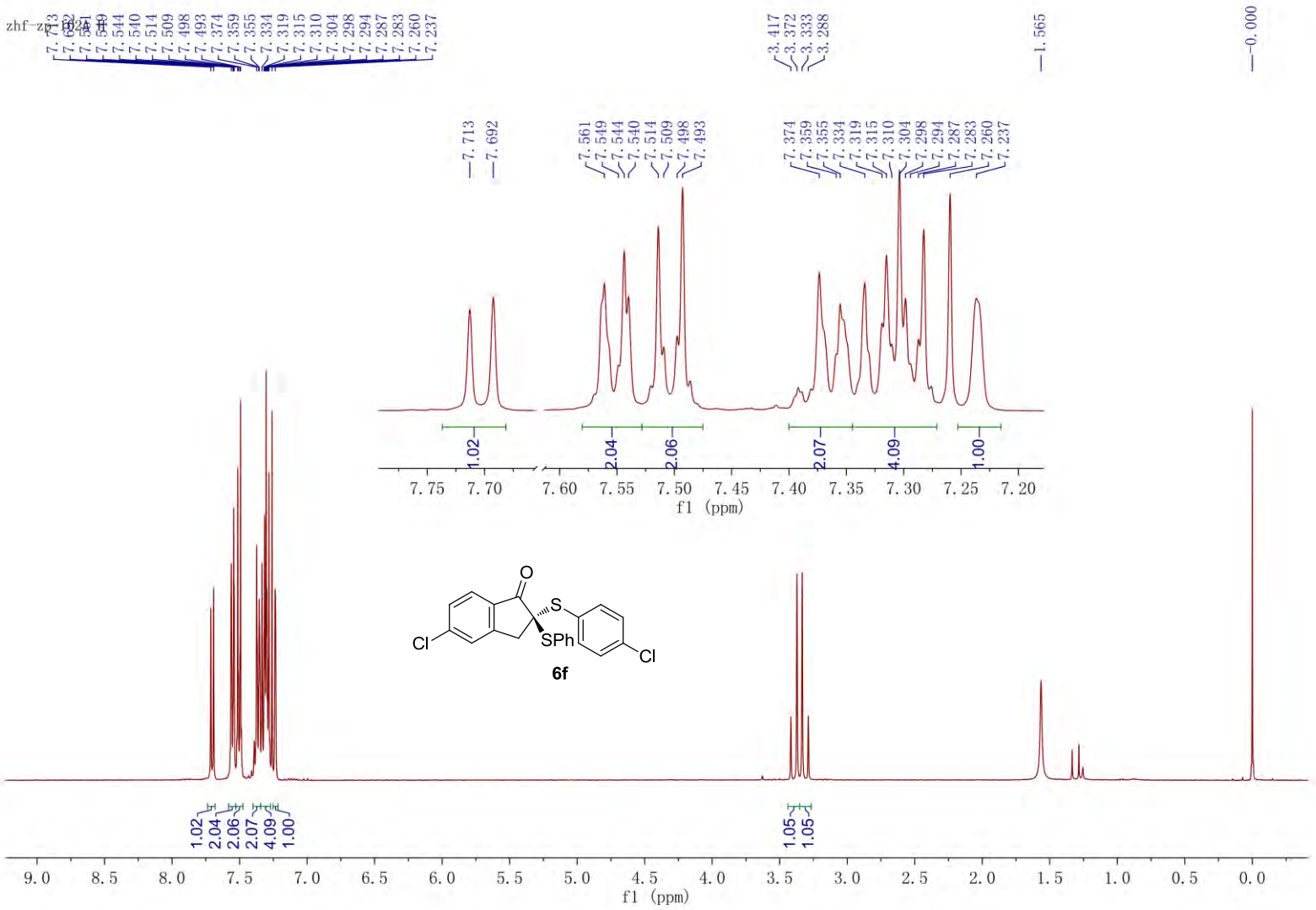

zhf-zp-071 C
184.13
160.08
138.16
136.92
136.57
136.14
130.05
129.18
129.02
128.56
128.46
127.33
122.21
119.50
117.67
77.44
77.13
76.81
73.28
66.48
O
SPh
S
O
Cl
6c
f1 (ppm)

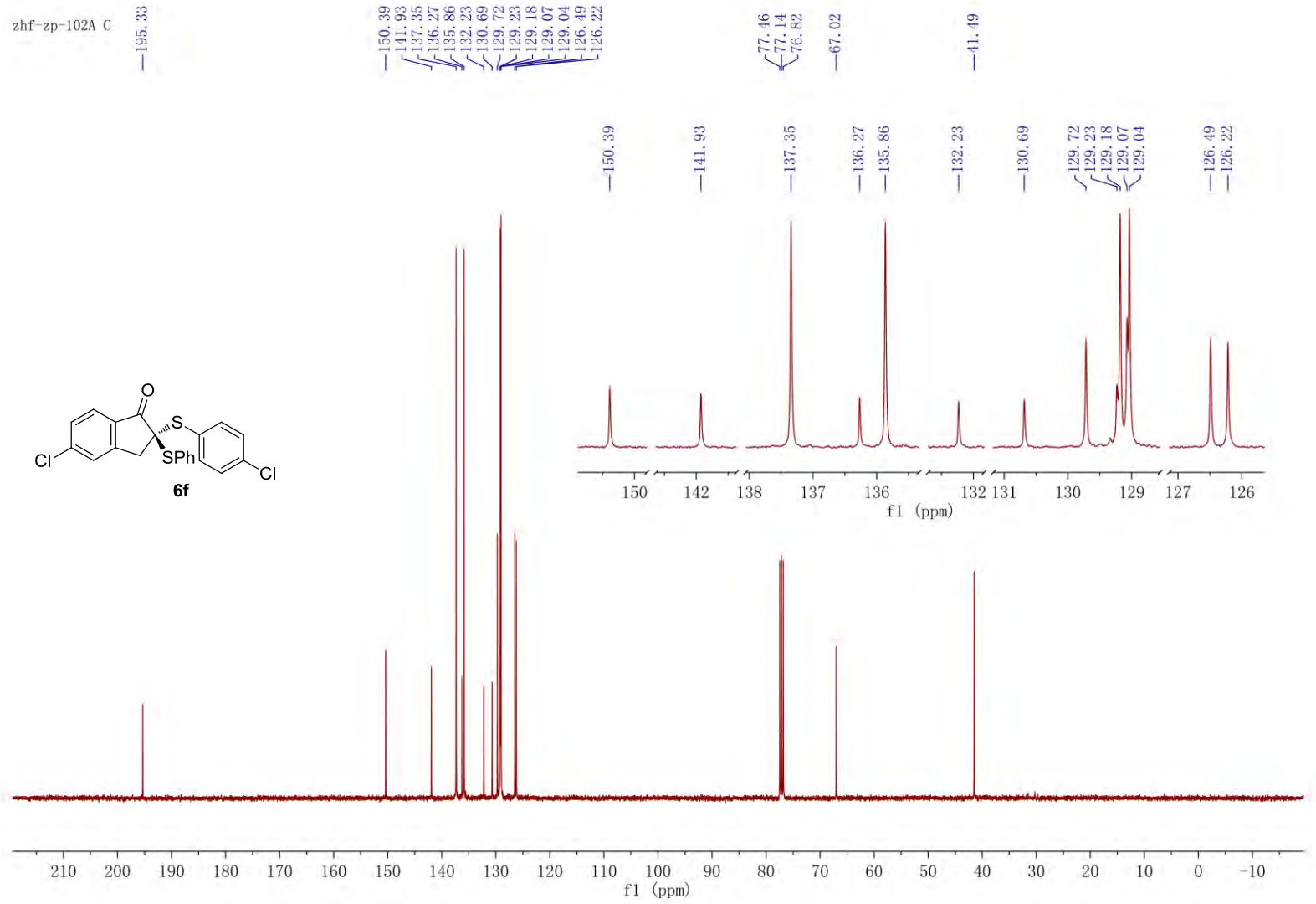

ZHF-ZP-104 A
7.459
7.441
7.303
7.299
7.286
7.282
7.268
7.265
7.260
7.253
7.247
7.242
7.234
7.231
7.226
7.197
7.179
7.176
7.159
7.153
7.148
7.137
7.132
7.097
7.078
3.244
1.564
0.000
1.11
1.10
2.12
1.06
1.17
2.00
4.16
1.05
2.04
f1 (ppm)
Cl
PhS
S
O
6d

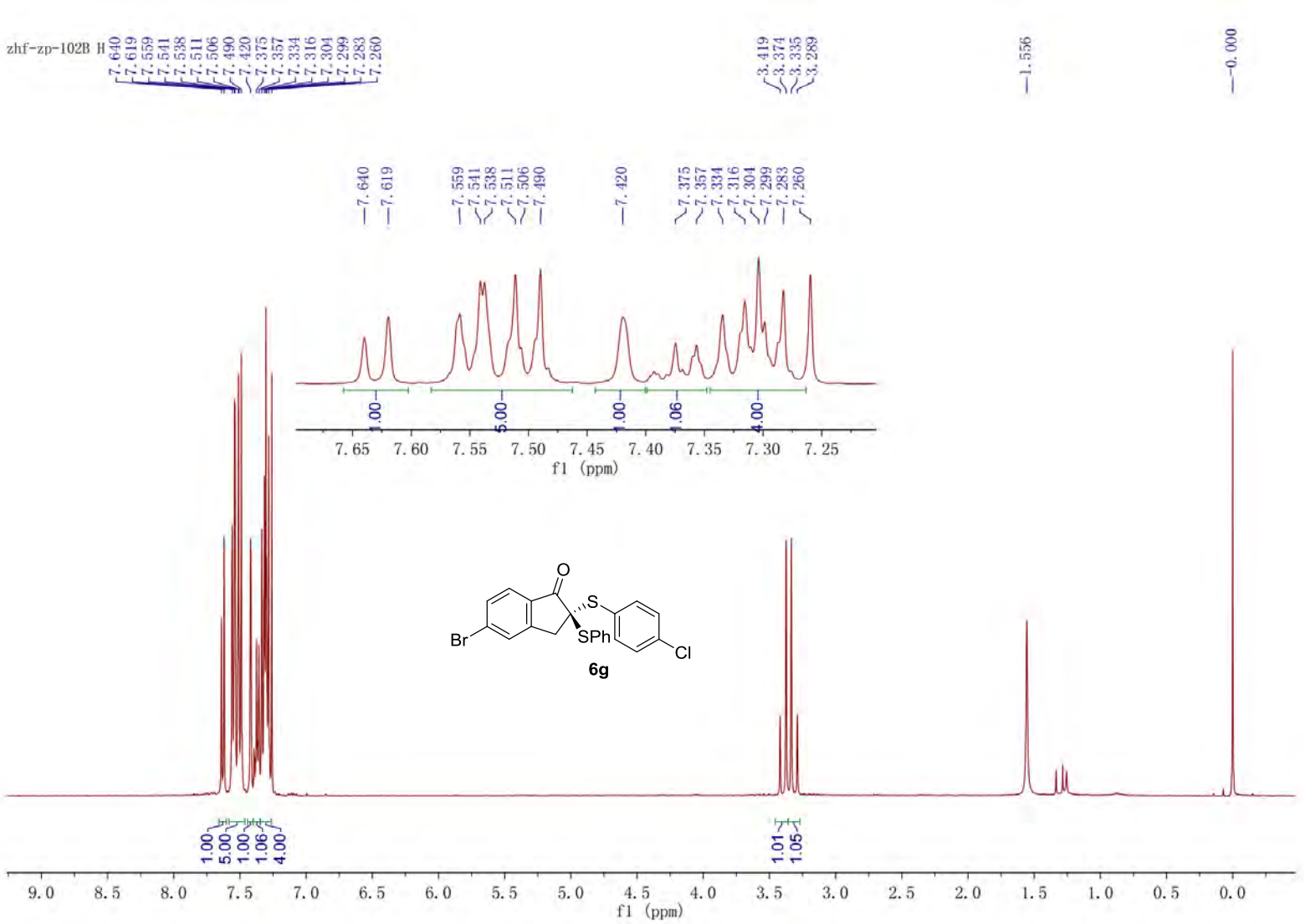

206.83
139.85
137.66
136.50
136.12
135.71
129.99
129.69
129.35
128.89
128.81
128.71
127.85
126.52
124.65
77.38
77.06
76.75
68.58
40.80
ZHF-ZP-104A C
Cl
PhS
S
O
6d
f1 (ppm)

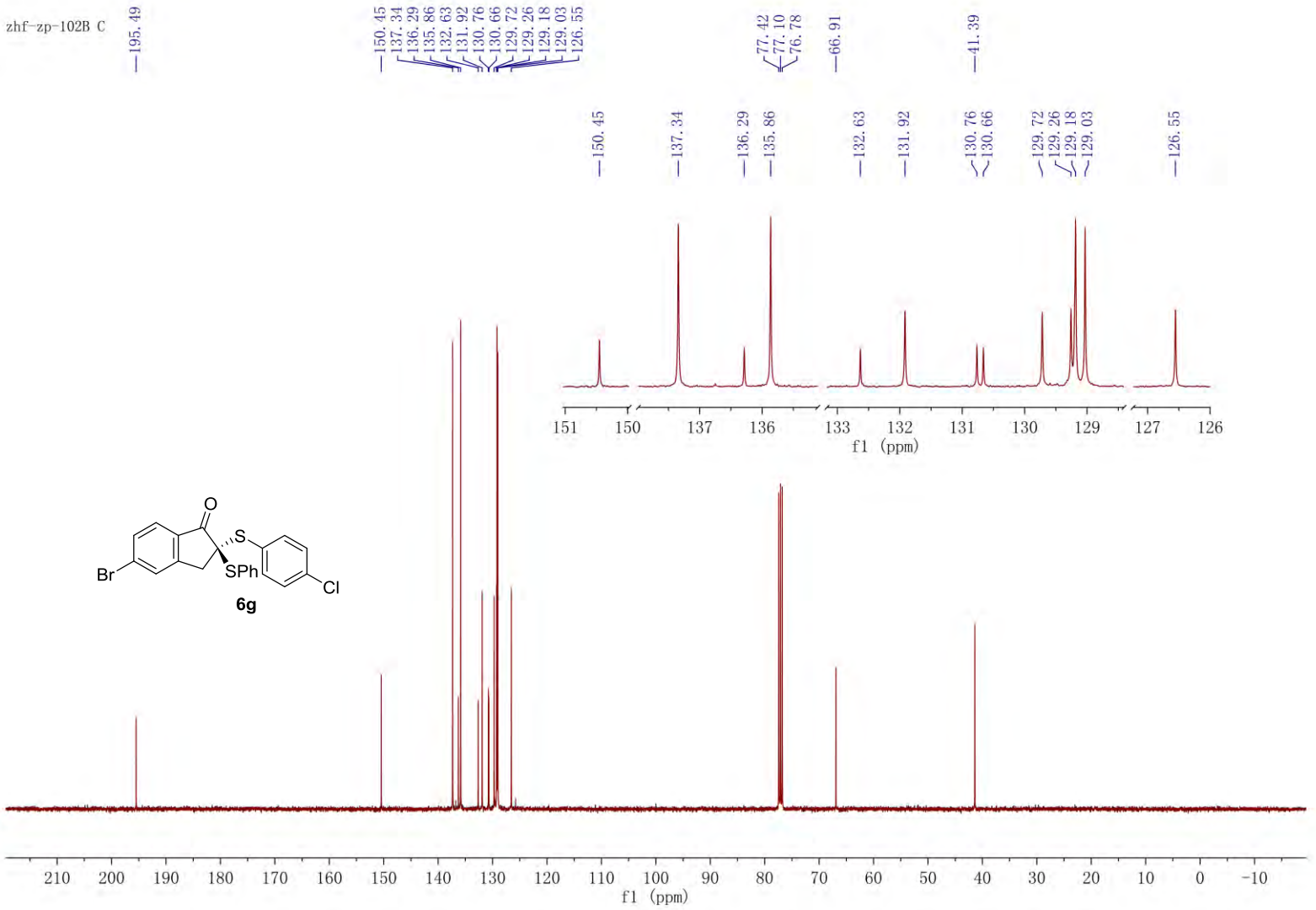

zhf-zp-036 H
7.788
7.769
7.582
7.578
7.574
7.562
7.558
7.531
7.523
7.518
7.507
7.502
7.398
7.379
7.357
7.343
7.339
7.335
7.321
7.320
7.310
7.306
7.289
7.284
7.272
7.268
7.256
7.245
7.226
3.458
3.414
3.372
3.327
1.591
0.000
O
S
SPh
Cl
6e
1.00
5.01
7.25
2.01
f1 (ppm)

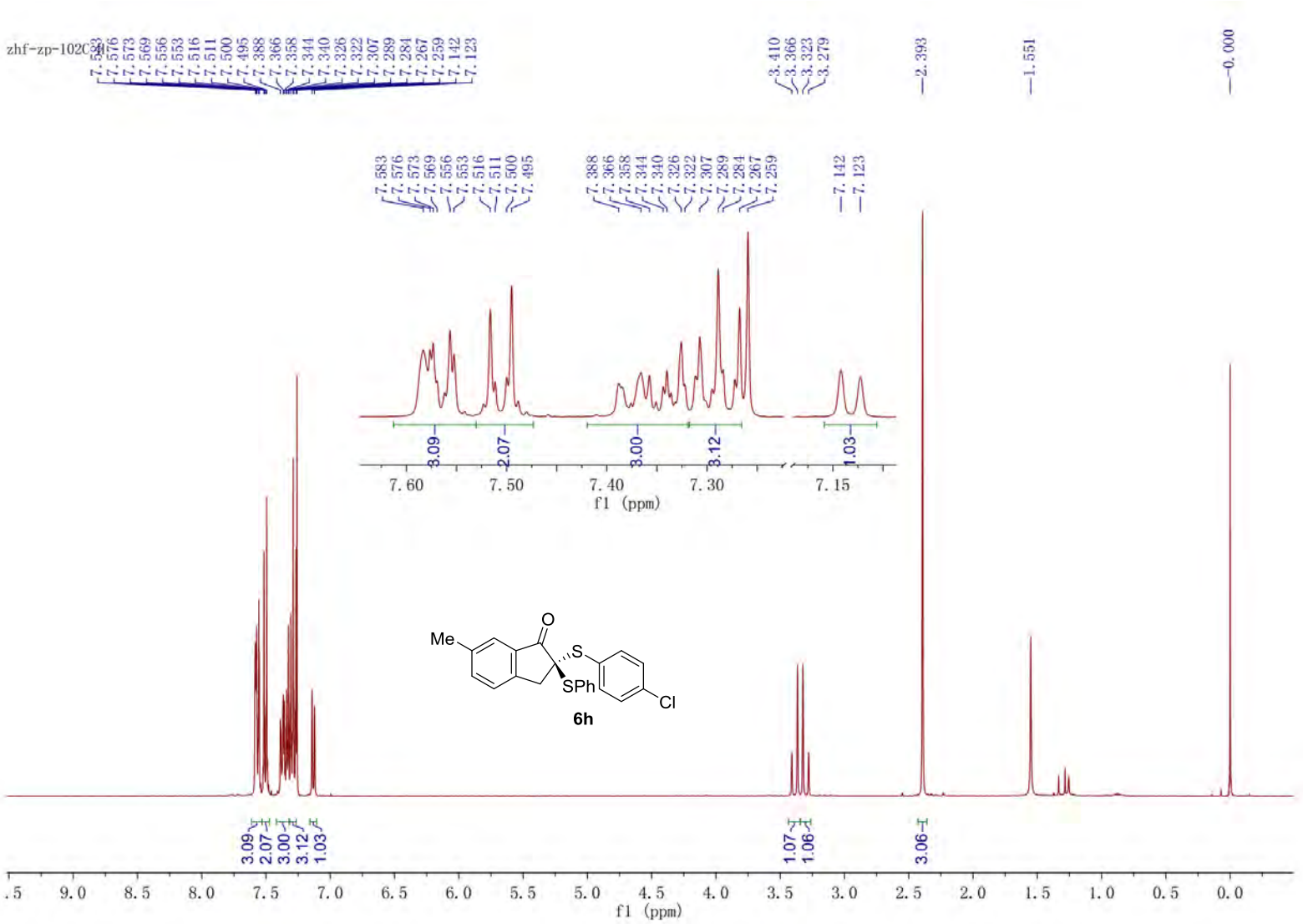

zhf-zp-036 C
196.66
148.89
137.21
136.01
135.71
135.35
133.72
130.94
129.48
129.45
129.02
128.87
128.19
125.86
125.35
77.32
77.00
76.68
67.00
41.87
O
S
SPh
Cl
6e
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

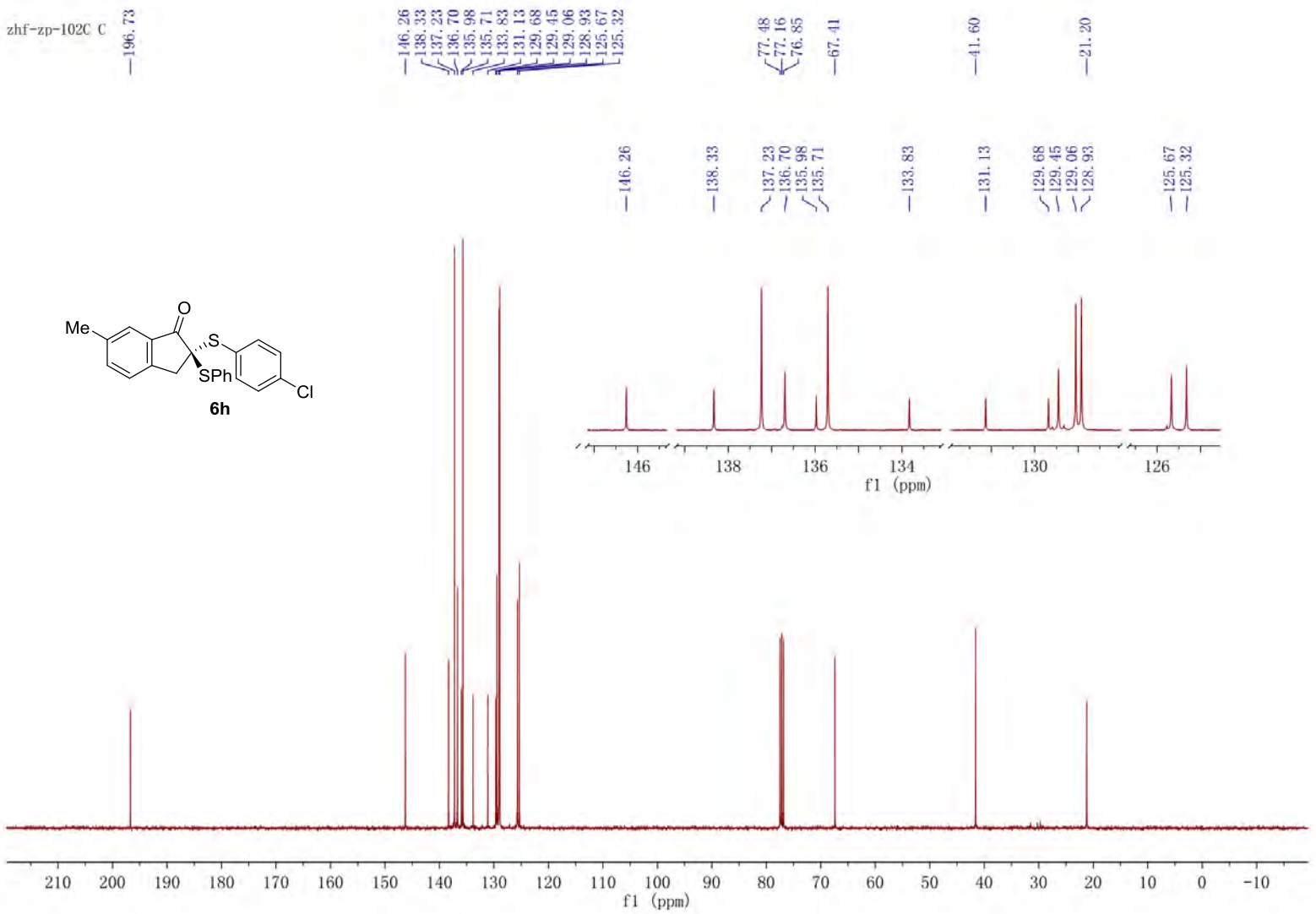

zhf-zp-102A-H
7.713
7.692
7.561
7.549
7.544
7.540
7.514
7.509
7.498
7.493
7.374
7.359
7.355
7.334
7.319
7.315
7.310
7.304
7.298
7.294
7.287
7.283
7.260
7.237
3.417
3.372
3.333
3.288
1.565
0.000
1.02
2.04
2.06
2.07
4.09
1.00
1.05
1.05
f1 (ppm)
O
S
SPh
Cl
Cl
6f

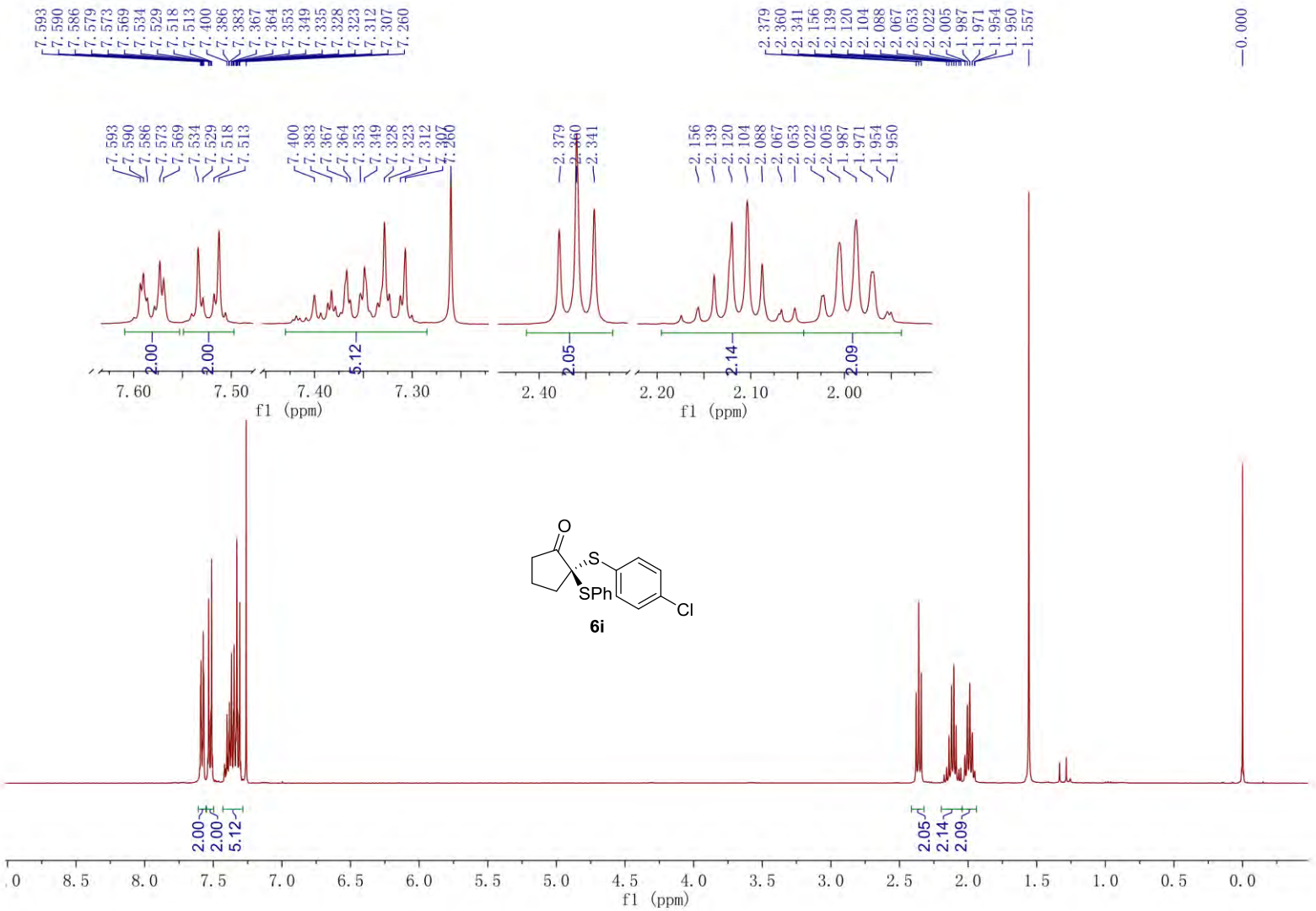

zhf-zp-102A C
195.33
150.39
141.93
137.35
136.27
135.86
132.23
130.69
129.72
129.23
129.18
129.07
129.04
126.49
126.22
77.46
77.14
76.82
67.02
41.49
O
S
SPh
Cl
Cl
6f
f1 (ppm)

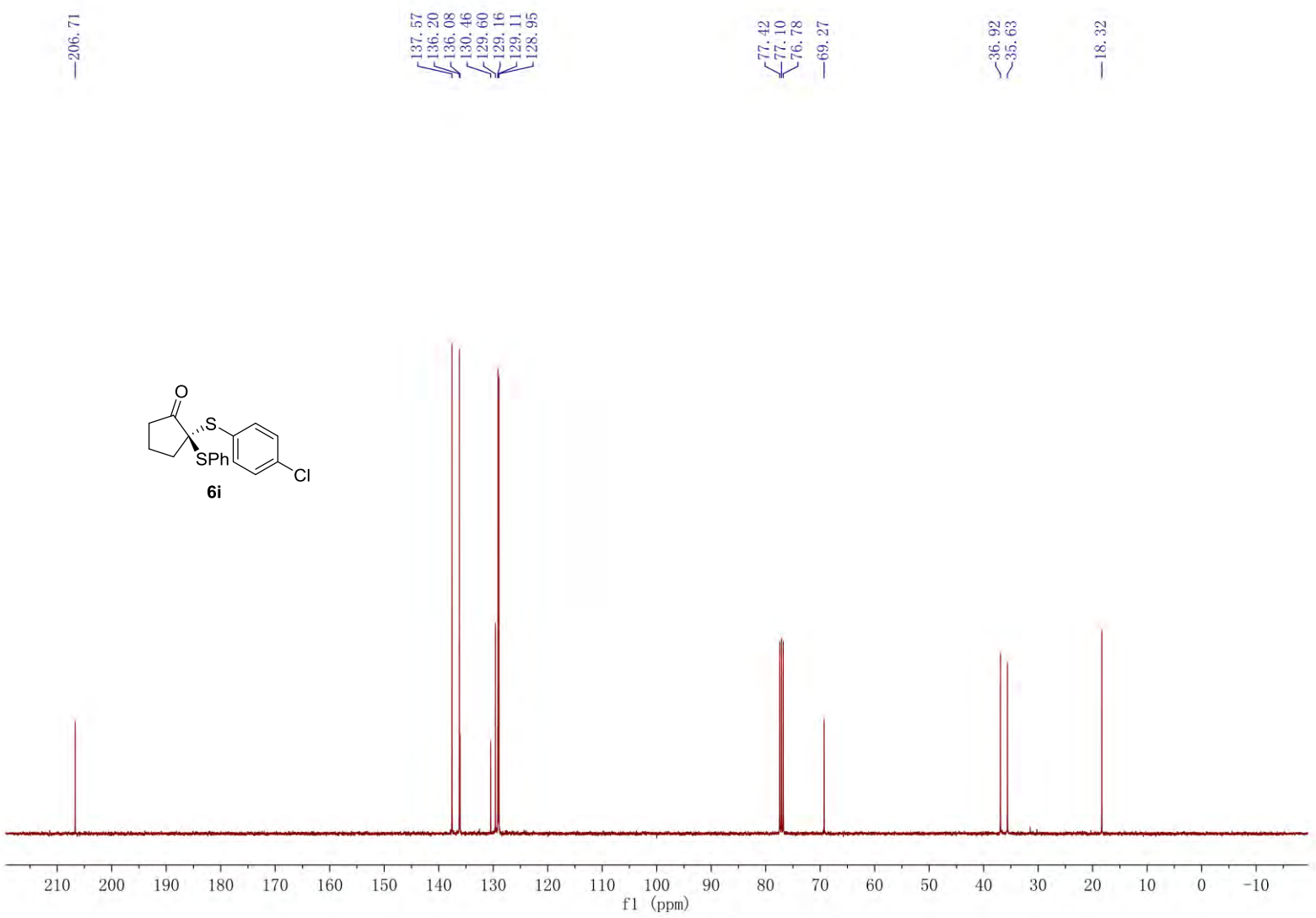

zhf-zp-102B H
7.640
7.619
7.559
7.541
7.538
7.511
7.506
7.490
7.420
7.375
7.357
7.334
7.316
7.304
7.299
7.283
7.260
3.419
3.374
3.335
3.289
1.556
0.000
1.00
5.00
1.00
1.06
4.00
1.01
1.05
f1 (ppm)
O
S
SPh
Br
Cl
6g

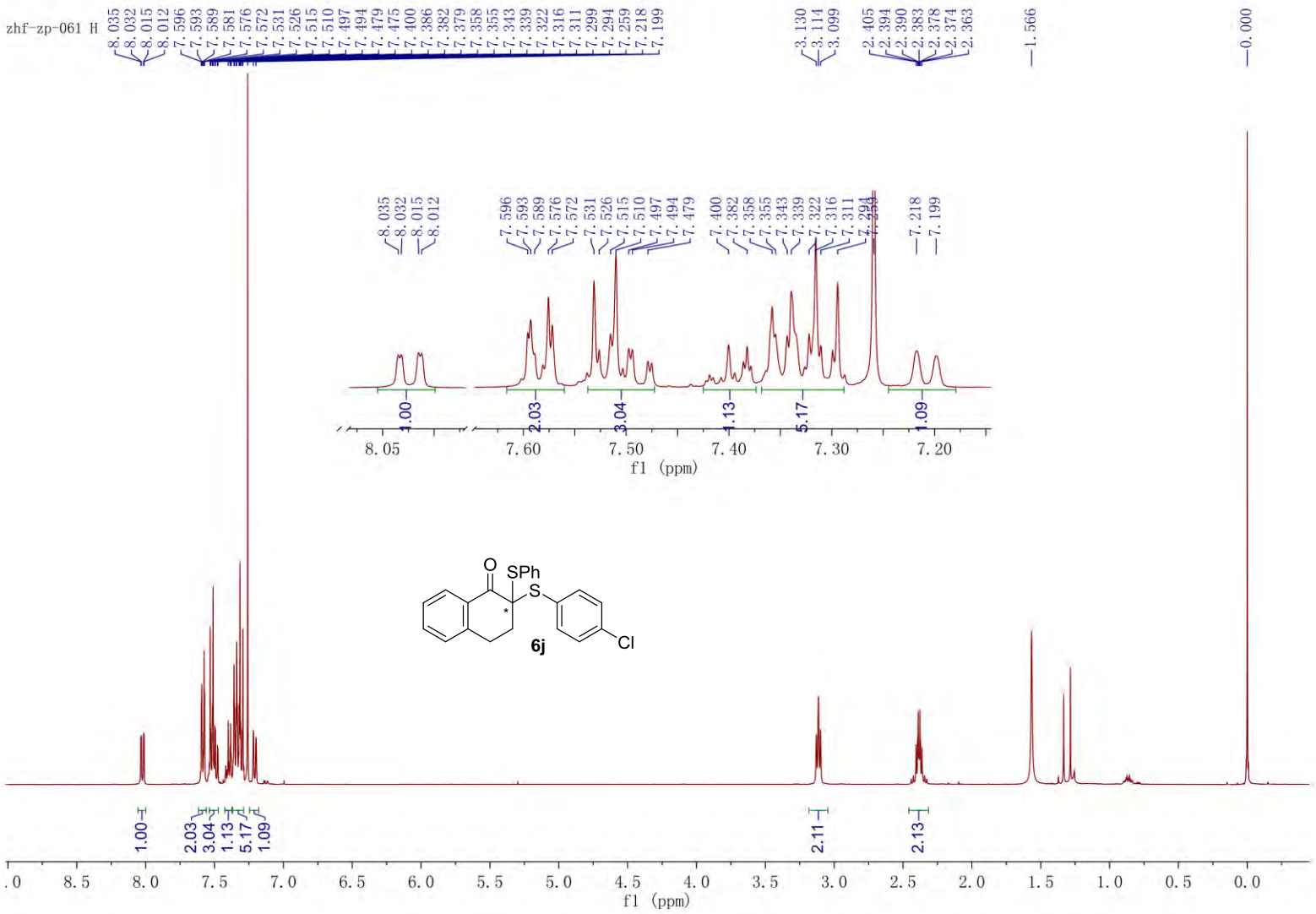

zhf-zp-102B C
195.49
150.45
137.34
136.29
135.86
132.63
131.92
130.76
130.66
129.72
129.26
129.18
129.03
126.55
77.42
77.10
76.78
66.91
41.39
f1 (ppm)
O
S
SPh
Br
Cl
6g

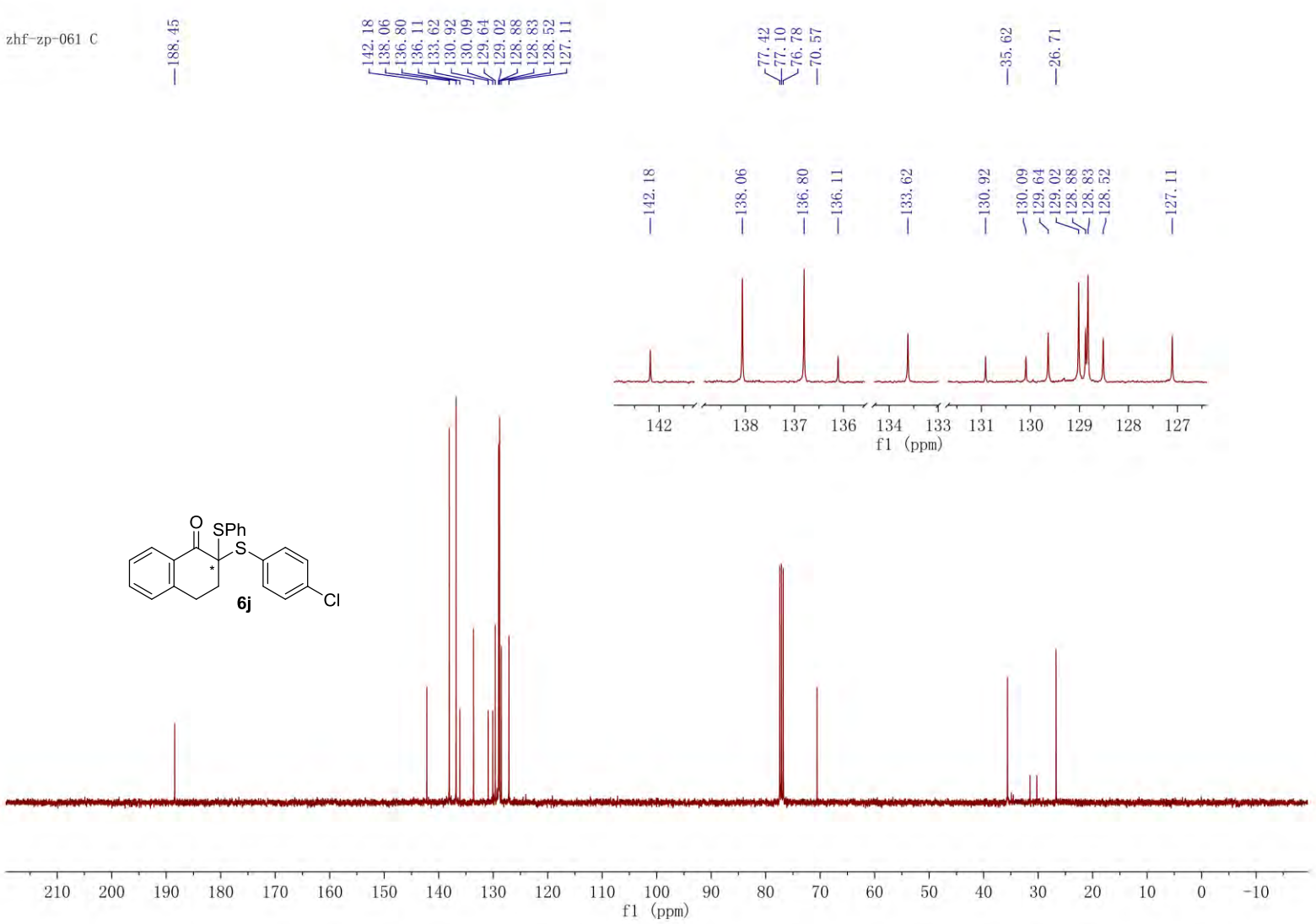

zhf-zp-102C3H
7.583
7.576
7.573
7.569
7.556
7.553
7.516
7.511
7.500
7.495
7.388
7.366
7.358
7.344
7.340
7.326
7.322
7.307
7.289
7.284
7.267
7.259
7.142
7.123
3.410
3.366
3.323
3.279
2.393
1.551
0.000
3.09
2.07
3.00
3.12
1.03
1.07
1.06
3.06
7.60
7.50
7.40
7.30
7.15
f1 (ppm)
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Me
O
S
SPh
Cl
6h

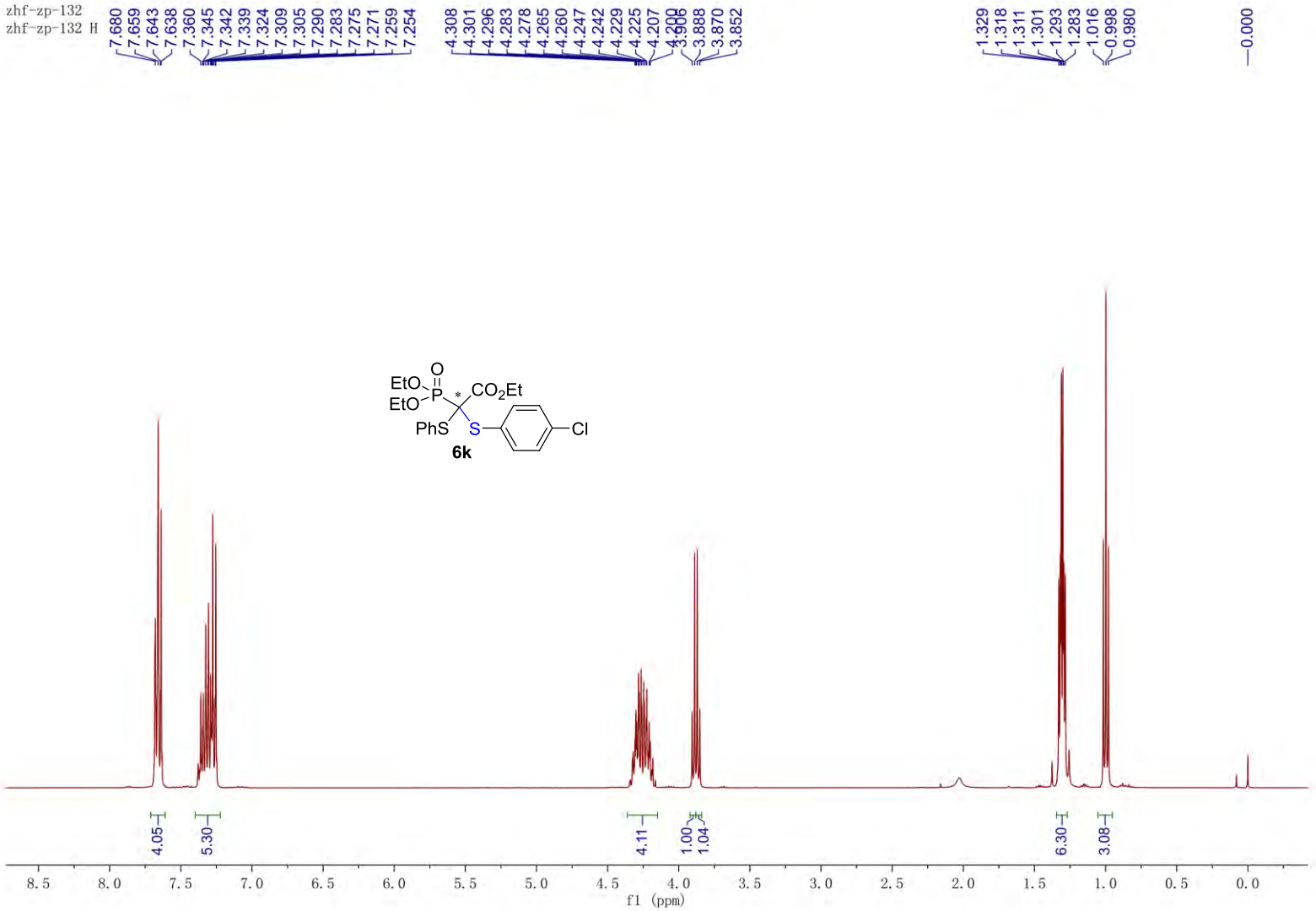

zhf-zp-102C C
196.73
146.26
138.33
137.23
136.70
135.98
135.71
133.83
131.13
129.68
129.45
129.06
128.93
125.67
125.32
77.48
77.16
76.85
67.41
41.60
21.20
Me
O
S
SPh
Cl
6h
f1 (ppm)
f1 (ppm)

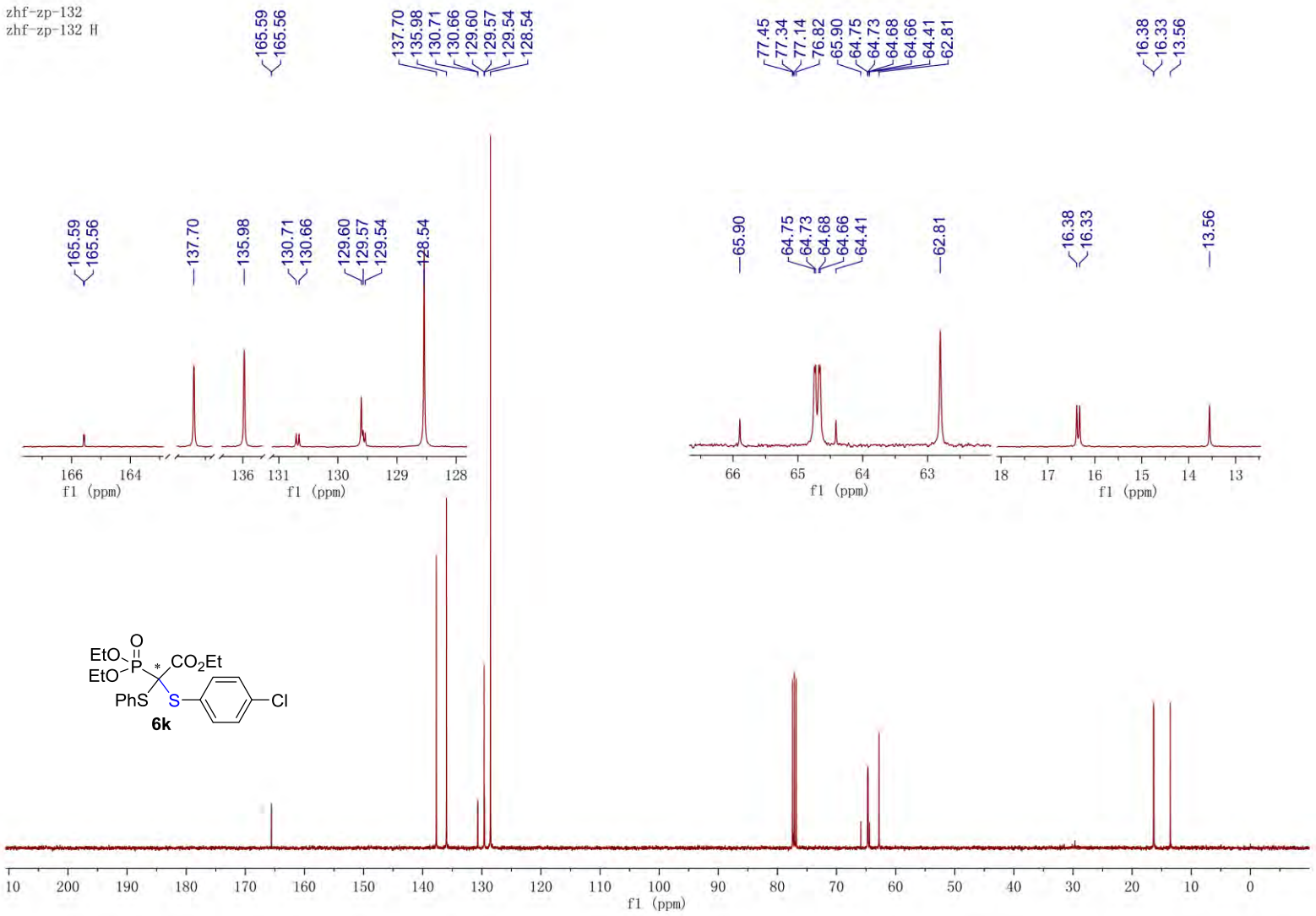

7.593
7.590
7.586
7.579
7.573
7.569
7.534
7.529
7.518
7.513
7.400
7.386
7.383
7.367
7.364
7.353
7.349
7.335
7.328
7.323
7.312
7.307
7.260
2.379
2.360
2.341
2.156
2.139
2.120
2.104
2.088
2.067
2.053
2.022
2.005
1.987
1.971
1.954
1.950
1.557
0.000
2.00
2.00
5.12
2.05
2.14
2.09
7.60
7.50
7.40
7.30
2.40
2.20
2.10
2.00
f1 (ppm)
O
S
SPh
Cl
6i


206.71
137.57
136.20
136.08
130.46
129.60
129.16
129.11
128.95
77.42
77.10
76.78
69.27
36.92
35.63
18.32
O
S
SPh
Cl
6i
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

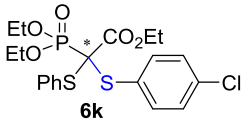

zhf-zp-061 H
8.035
8.032
8.015
8.012
7.596
7.593
7.589
7.581
7.576
7.572
7.531
7.526
7.515
7.510
7.497
7.494
7.479
7.475
7.400
7.386
7.382
7.379
7.358
7.355
7.343
7.339
7.322
7.316
7.311
7.299
7.294
7.259
7.218
7.199
3.130
3.114
3.099
2.405
2.394
2.390
2.383
2.378
2.374
2.363
1.566
0.000
1.00
2.03
3.04
1.13
5.17
1.09
2.11
2.13
f1 (ppm)
O
SPh
S
Cl
6j


zhf-zp-061 C
188.45
142.18
138.06
136.80
136.11
133.62
130.92
130.09
129.64
129.02
128.88
128.83
128.52
127.11
77.42
77.10
76.78
70.57
35.62
26.71
O
SPh
S
Cl
6j
f1 (ppm)

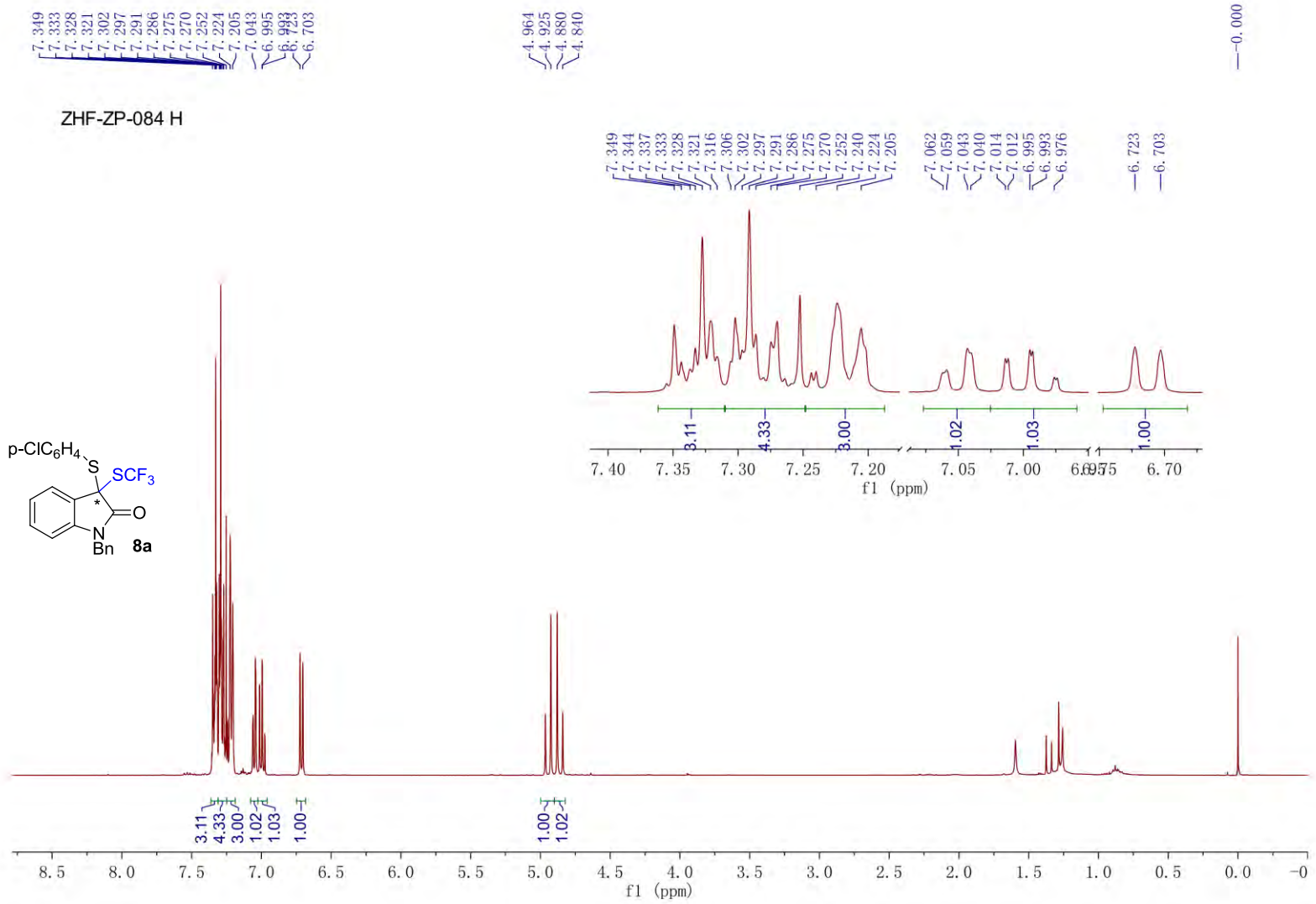

zhf-zp-132
zhf-zp-132 H
7.680
7.659
7.643
7.638
7.360
7.345
7.342
7.339
7.324
7.309
7.305
7.290
7.283
7.275
7.271
7.259
7.254
4.308
4.301
4.296
4.283
4.278
4.265
4.260
4.247
4.242
4.229
4.225
4.207
3.888
3.870
3.852
1.329
1.318
1.311
1.301
1.293
1.283
1.016
0.998
0.980
0.000
EtO
EtO
P
O
CO2Et
PhS
S
Cl
6k
4.05
5.30
4.11
1.00
1.04
6.30
3.08
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

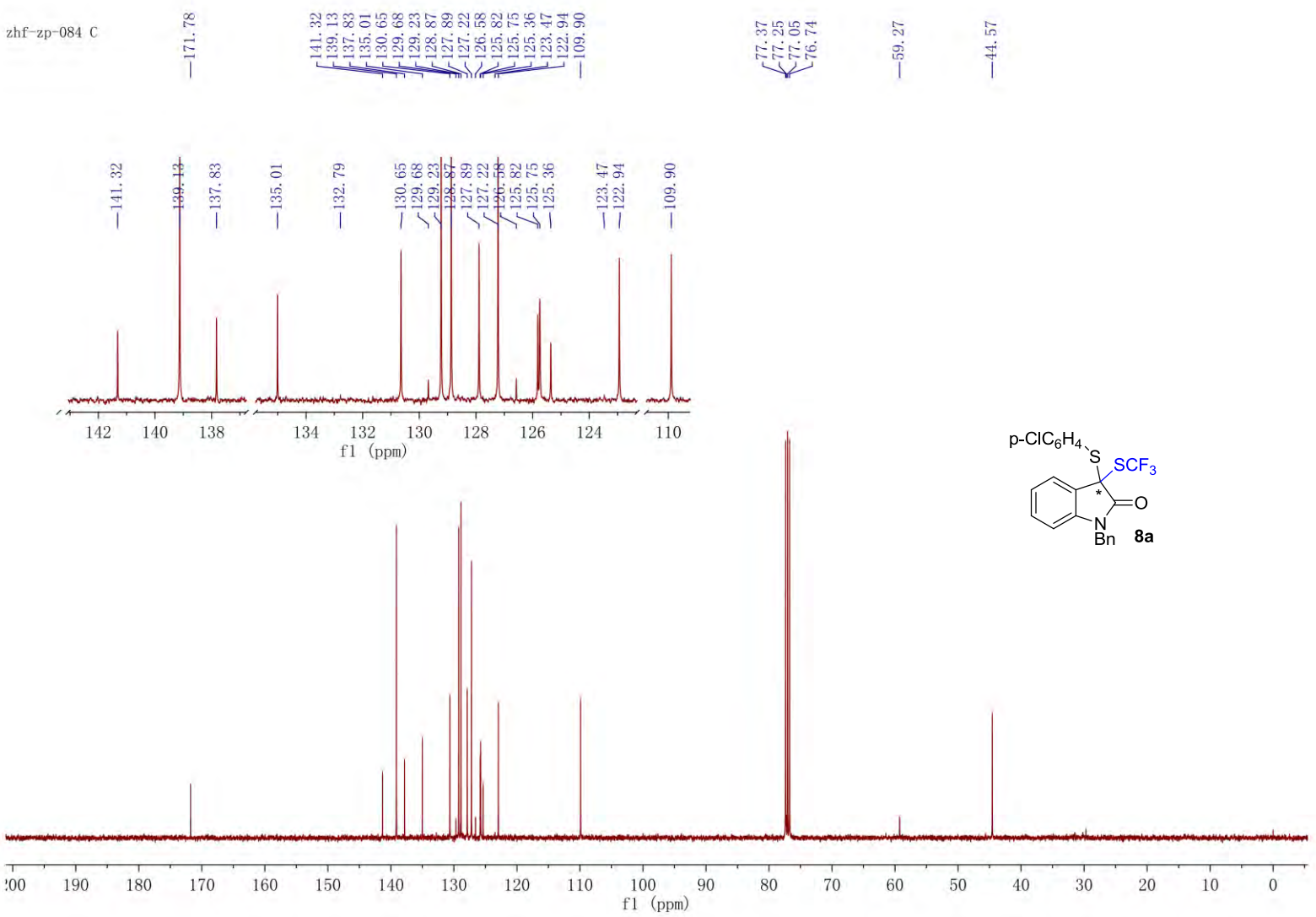

zhf-zp-132
zhf-zp-132 H
165.59
165.56
137.70
135.98
130.71
130.66
129.60
129.57
129.54
128.54
77.45
77.34
77.14
76.82
65.90
64.75
64.73
64.68
64.66
64.41
62.81
16.38
16.33
13.56
f1 (ppm)
EtO
EtO
P
O
CO2Et
PhS
S
Cl
6k

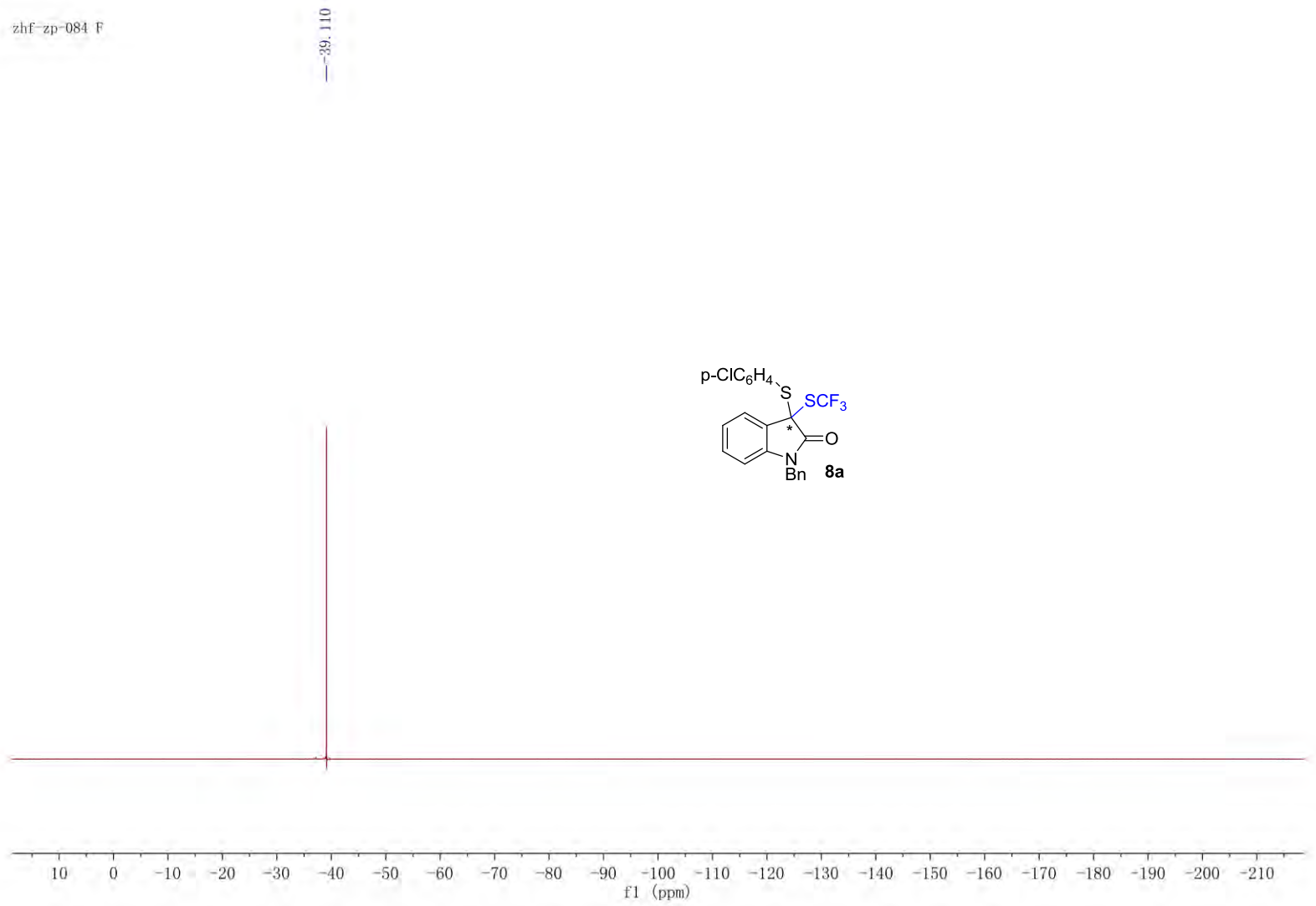
zhf-zp-132-P

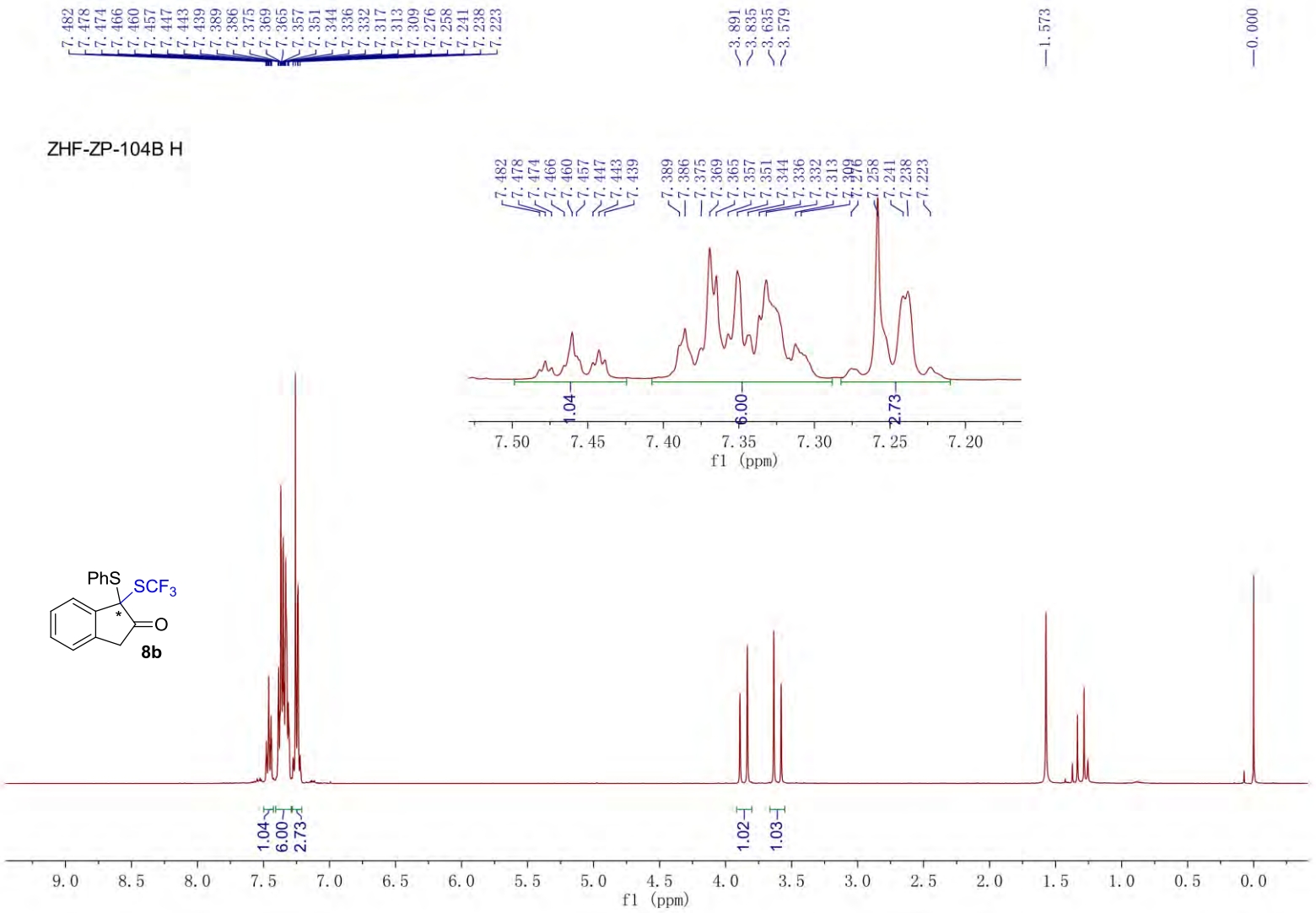


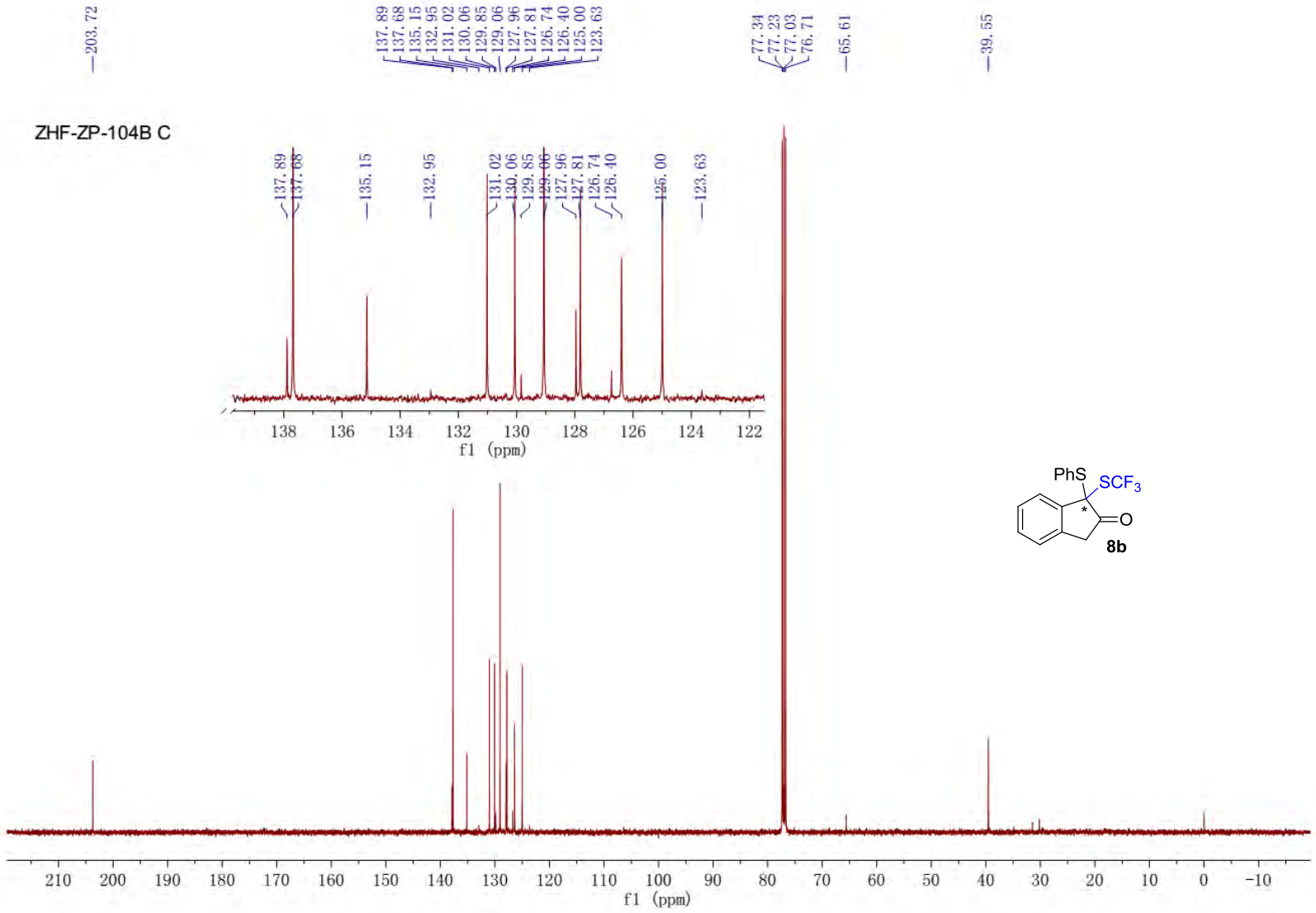

**6k**

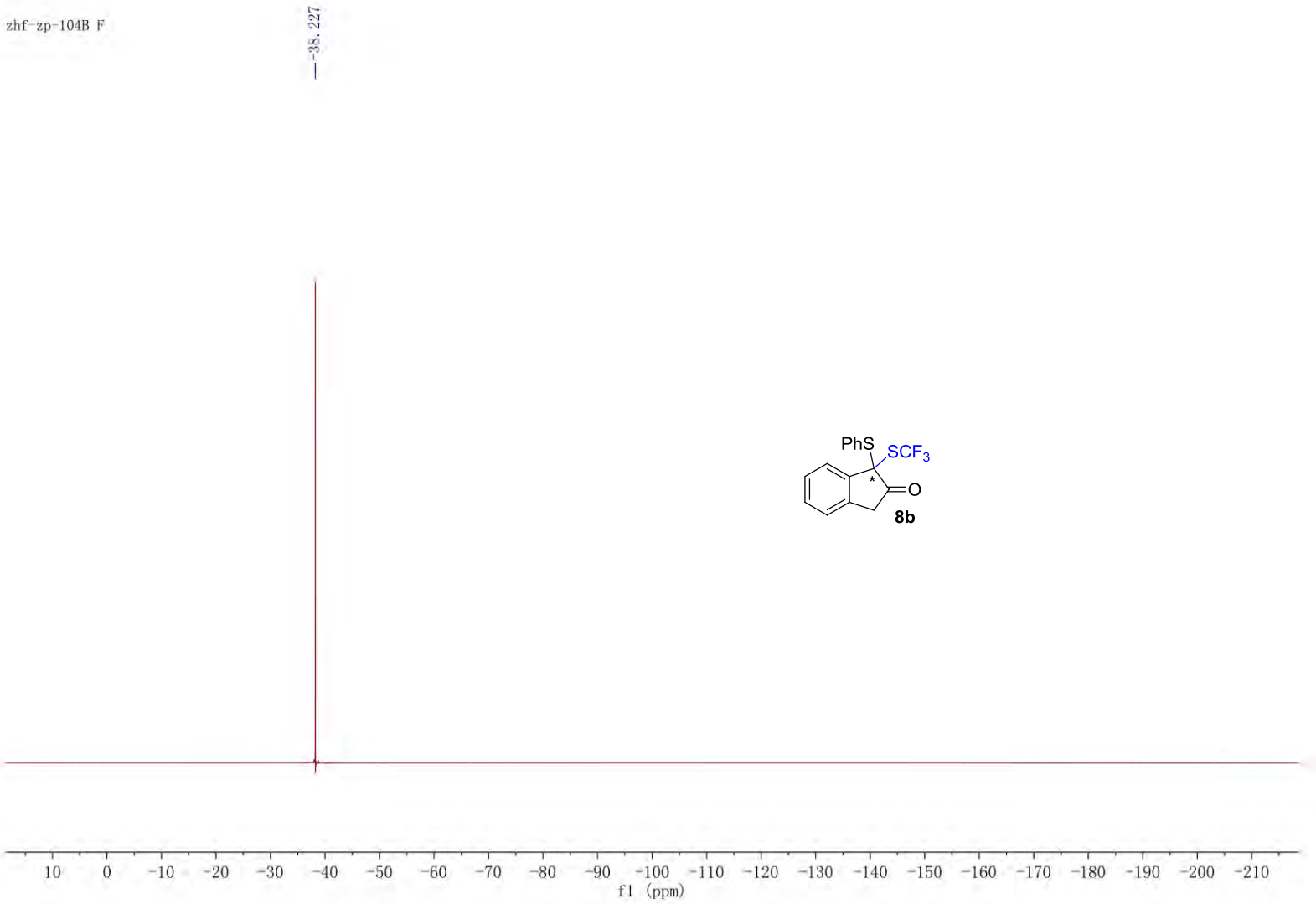

ZHF-ZP-084 H
p-ClC6H4
S
SCF3
O
N
Bn
8a
f1 (ppm)

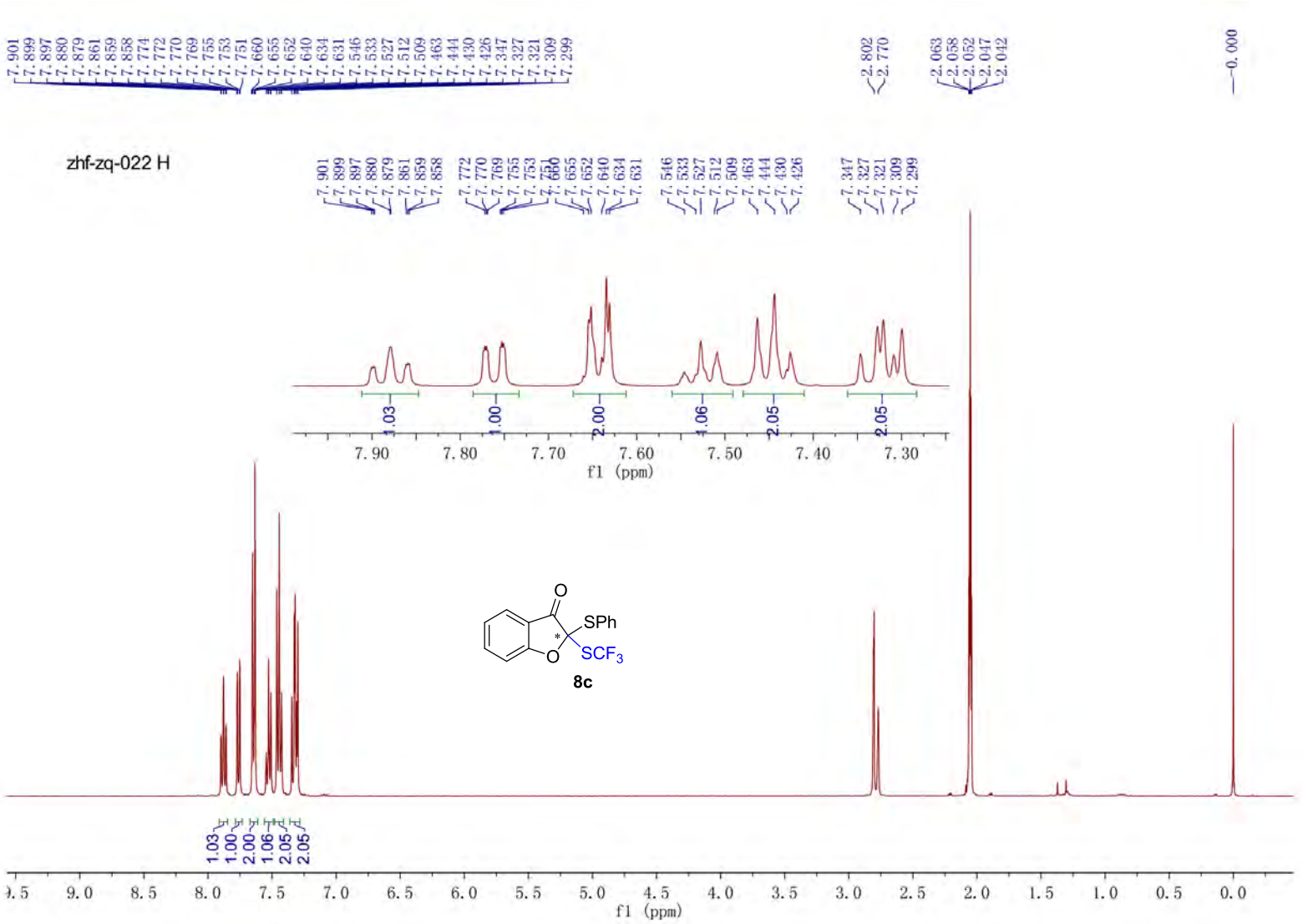

zhf-zp-084 C
171.78
141.32
139.13
137.83
135.01
130.65
129.68
129.23
128.87
127.89
127.22
126.58
125.82
125.75
125.36
123.47
122.94
109.90
77.37
77.25
77.05
76.74
59.27
44.57
f1 (ppm)
p-ClC6H4
S
SCF3
O
N
Bn
8a

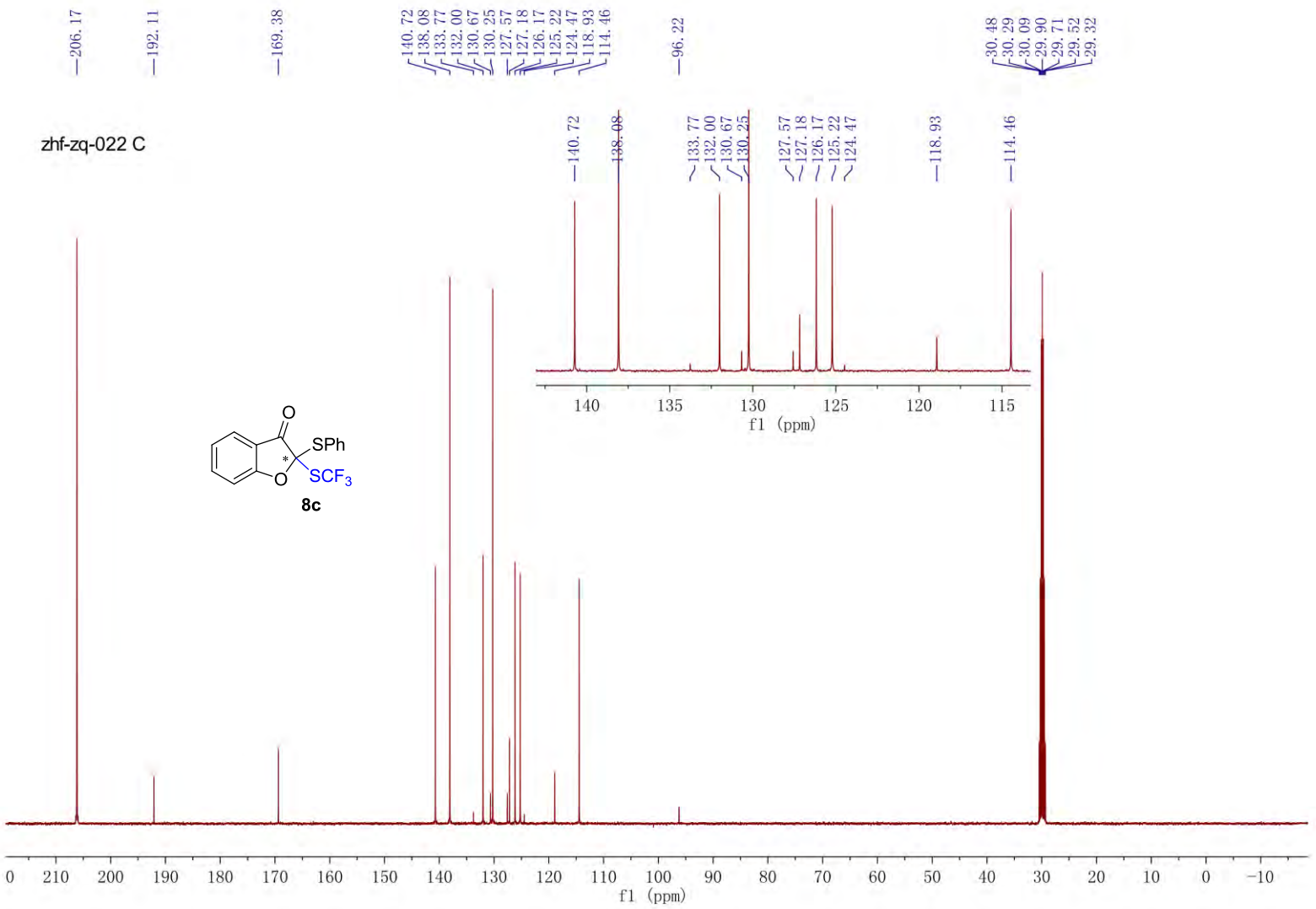

zhf-zp-084 F
-39.110
p-ClC6H4
S
SCF3
O
N
Bn
8a
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210
f1 (ppm)

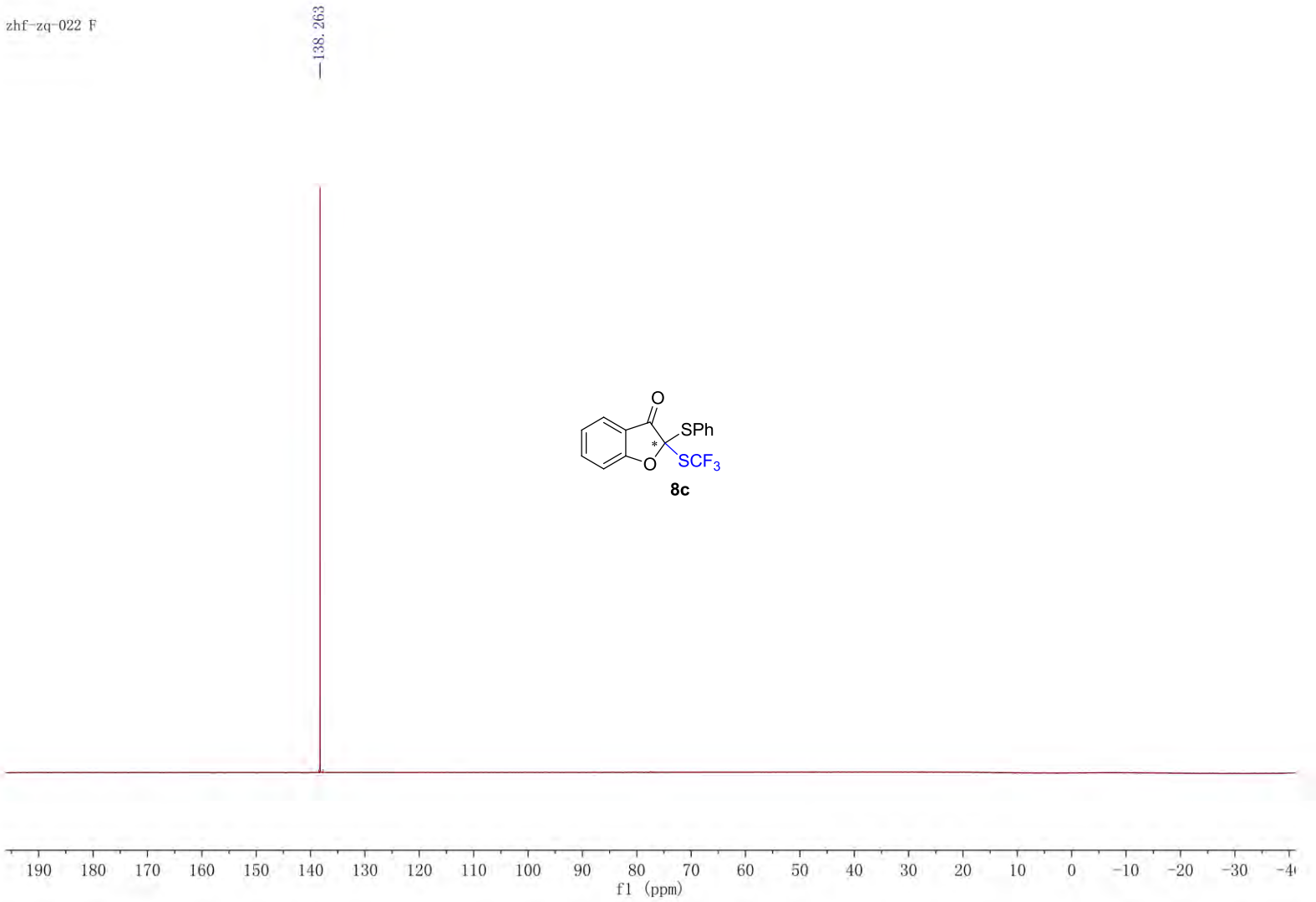

7.482
7.478
7.474
7.466
7.460
7.457
7.447
7.443
7.439
7.389
7.386
7.375
7.369
7.365
7.357
7.351
7.344
7.336
7.332
7.317
7.313
7.309
7.276
7.258
7.241
7.238
7.223
3.891
3.835
3.635
3.579
1.573
0.000
ZHF-ZP-104B H
1.04
6.00
2.73
1.02
1.03
f1 (ppm)
PhS
SCF3
O
8b

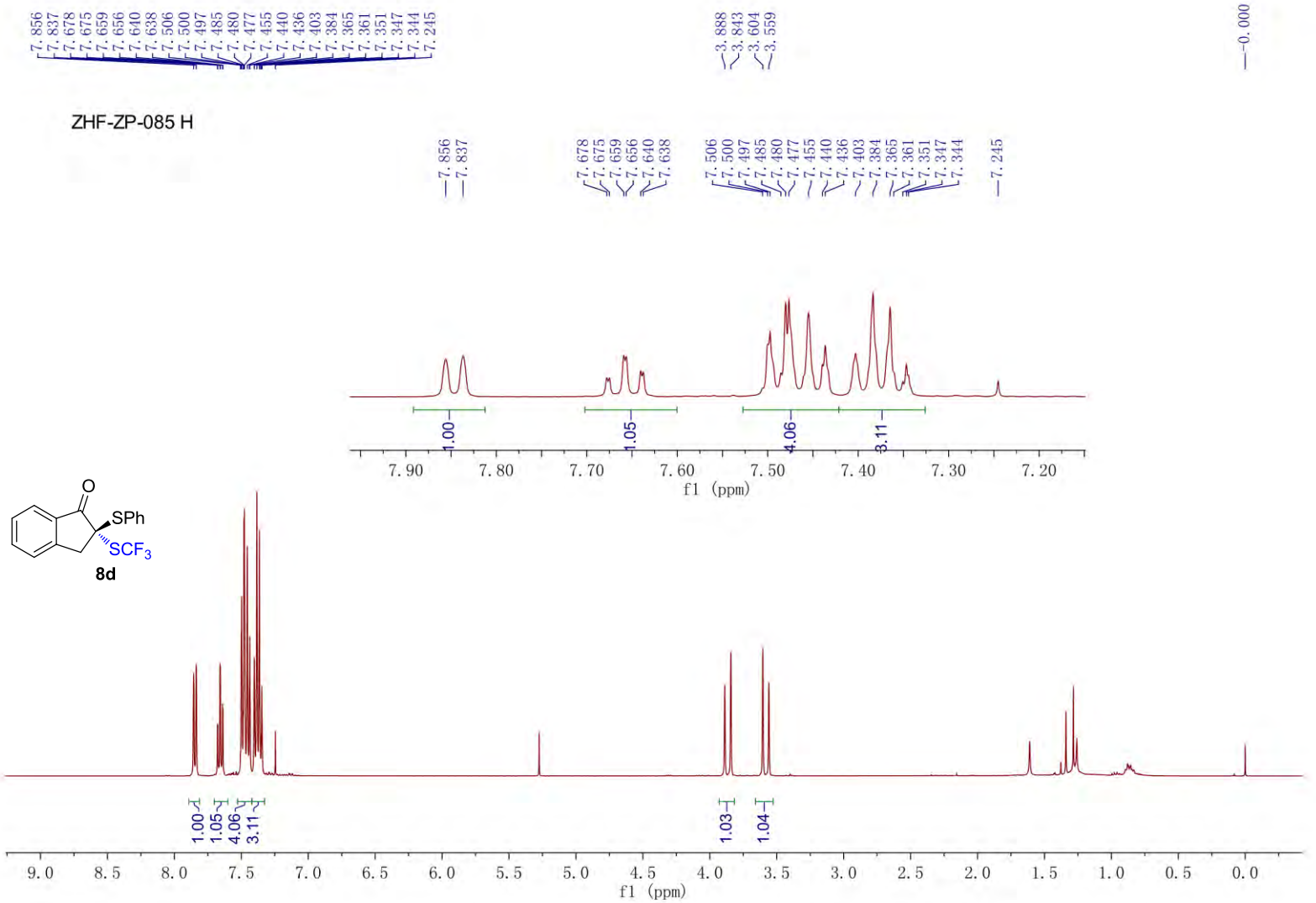

ZHF-ZP-104B C
203.72
137.89
137.68
135.15
132.95
131.02
130.06
129.85
129.06
127.96
127.81
126.74
126.40
125.00
123.63
77.34
77.23
77.03
76.71
65.61
39.55
f1 (ppm)
PhS
SCF3
O
8b

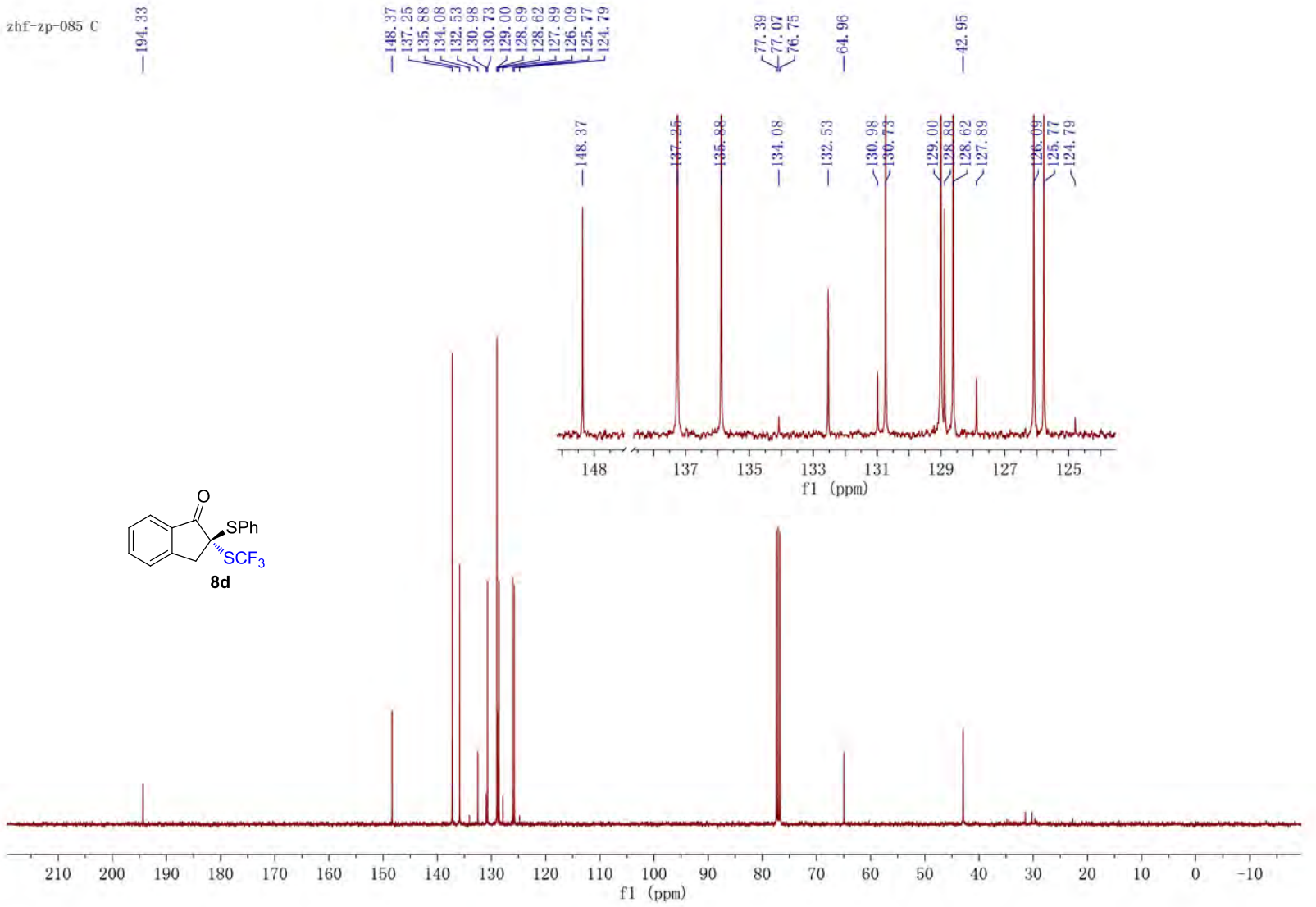

zhf-zp-104B F
-38.227
PhS
SCF3
O
*
8b
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210
f1 (ppm)

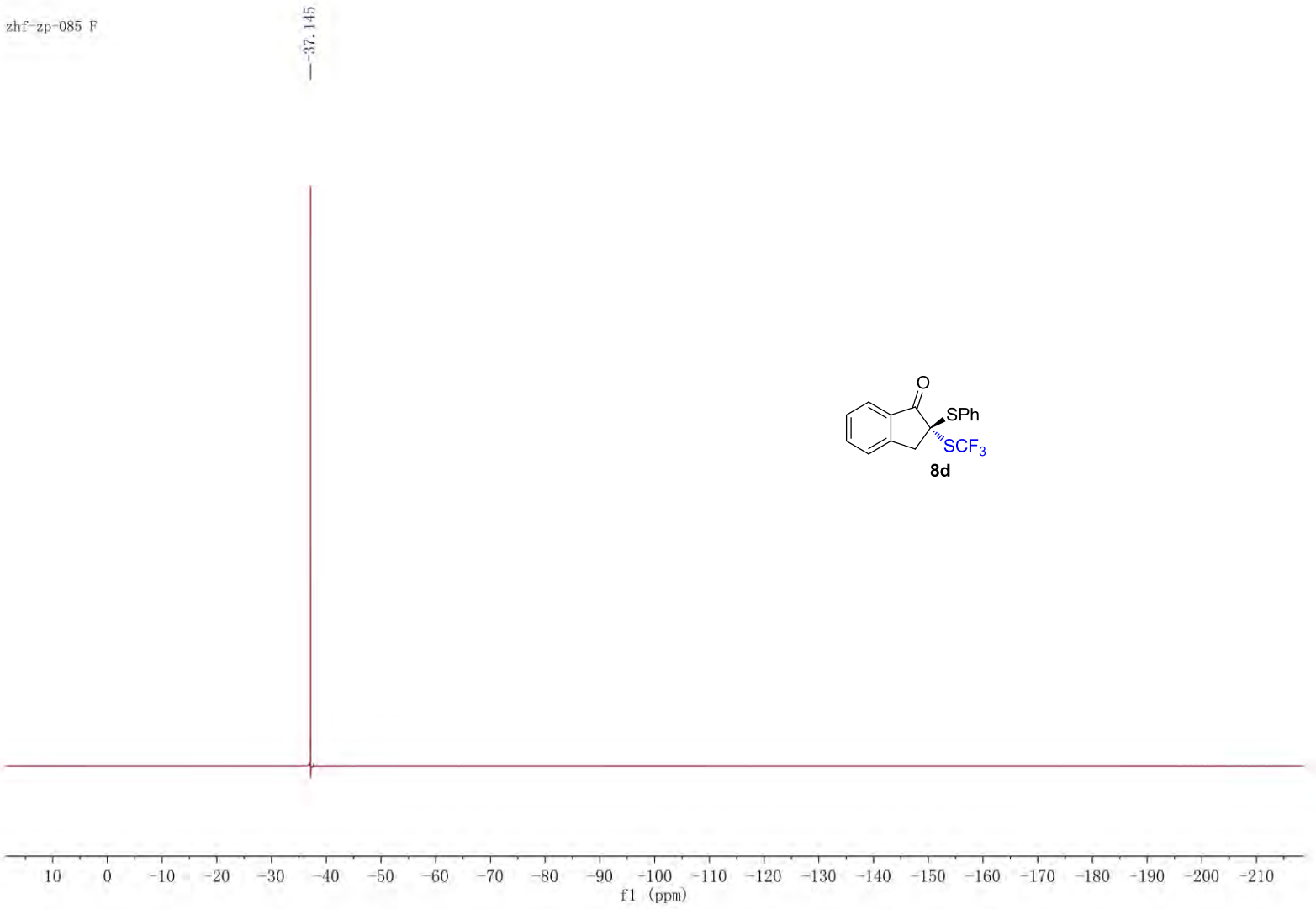

zhf-zq-022 H
f1 (ppm)
SPh
SCF3
8c

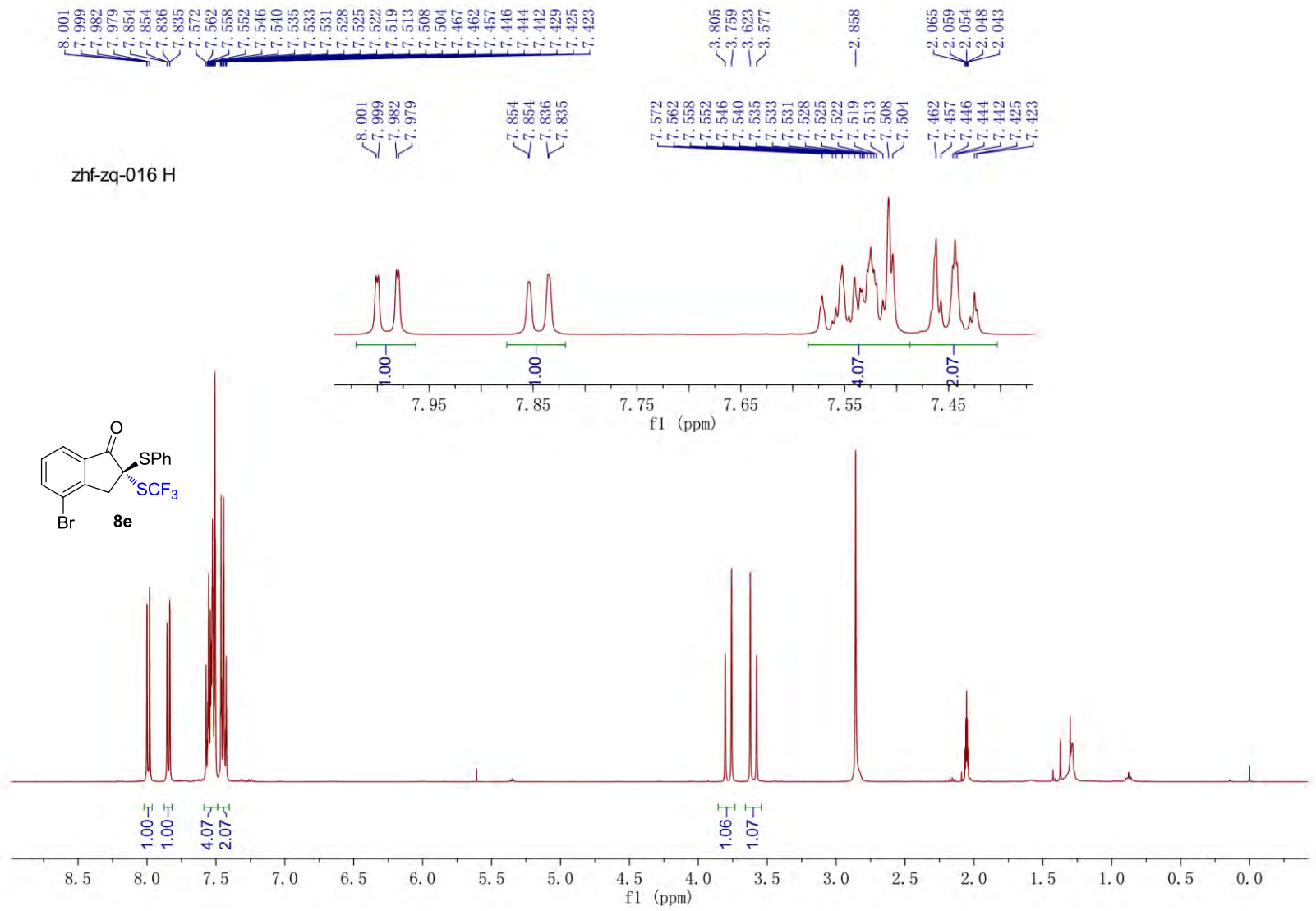

zhf-zq-022 C
206.17
192.11
169.38
140.72
138.08
133.77
132.00
130.67
130.25
127.57
127.18
126.17
125.22
124.47
118.93
114.46
96.22
30.48
30.29
30.09
29.90
29.71
29.52
29.32
O
SPh
SCF3
8c
f1 (ppm)

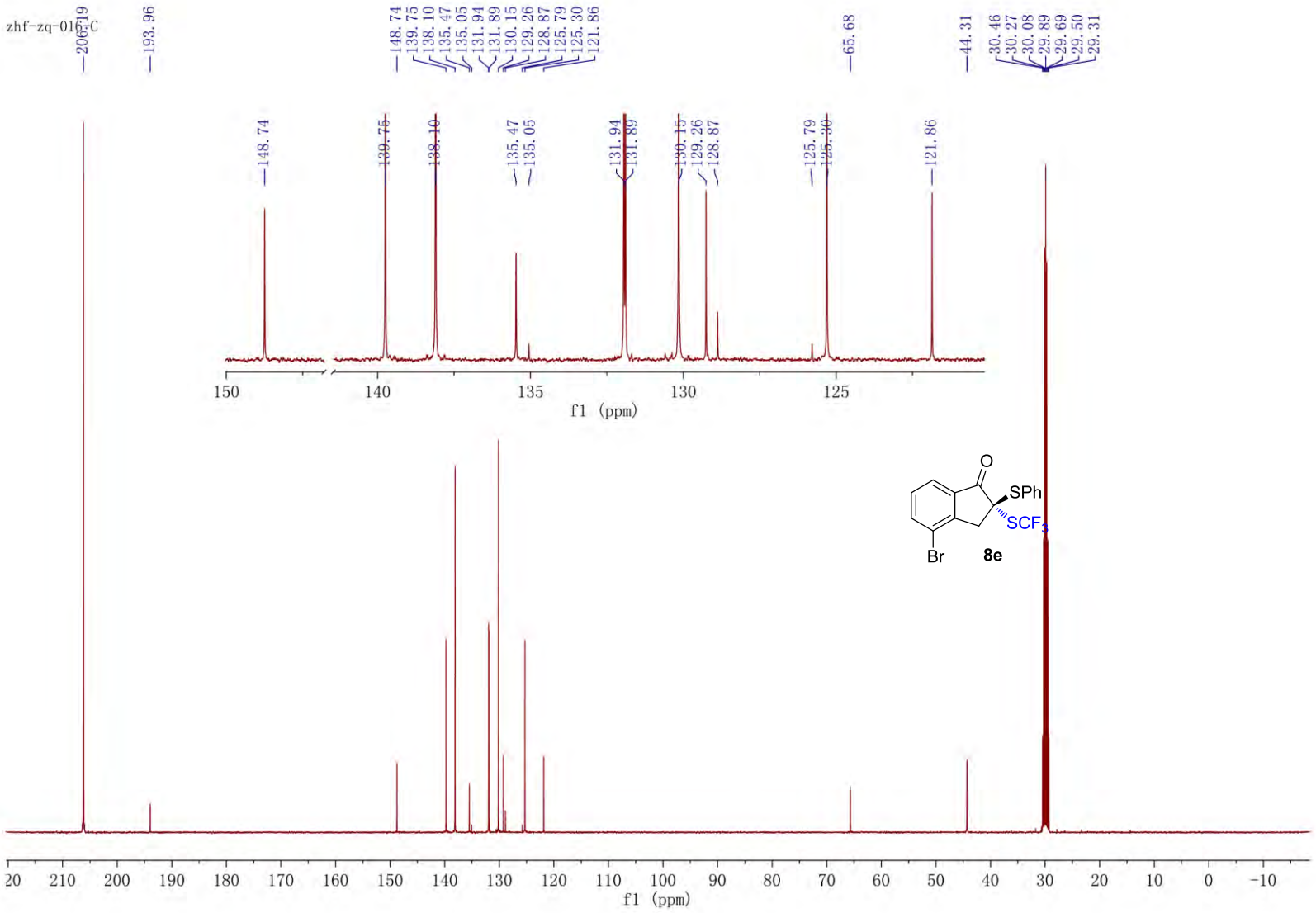

zhf-zq-022 F
138.263
O
SPh
SCF3
O
*
8c
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30
f1 (ppm)

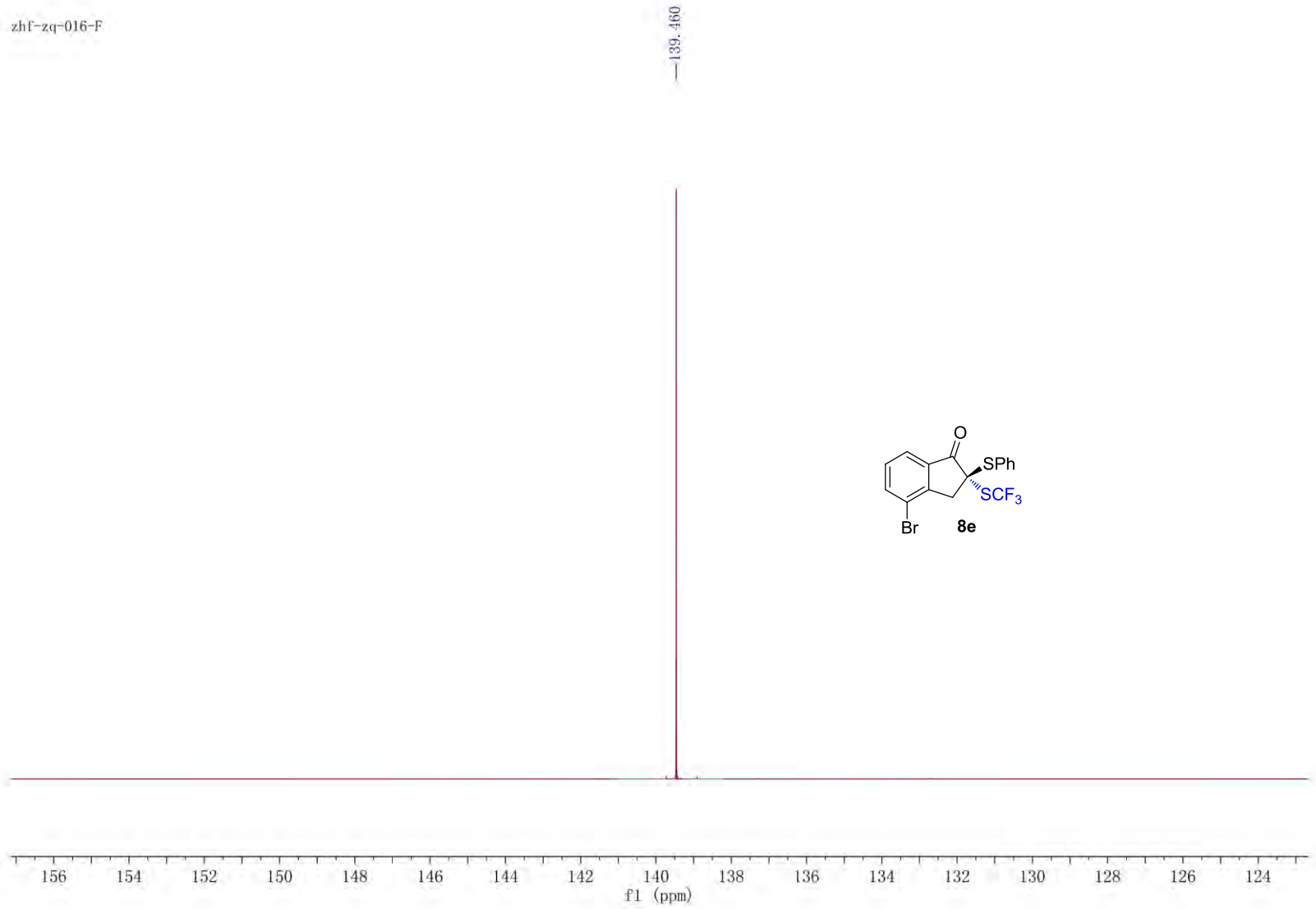

7.856
7.837
7.678
7.675
7.659
7.656
7.640
7.638
7.506
7.500
7.497
7.485
7.480
7.477
7.455
7.440
7.436
7.403
7.384
7.365
7.361
7.351
7.347
7.344
7.245
3.888
3.843
3.604
3.559
0.000
ZHF-ZP-085 H
1.00
1.05
4.06
3.11
f1 (ppm)
SPh
SCF3
8d
1.03
1.04

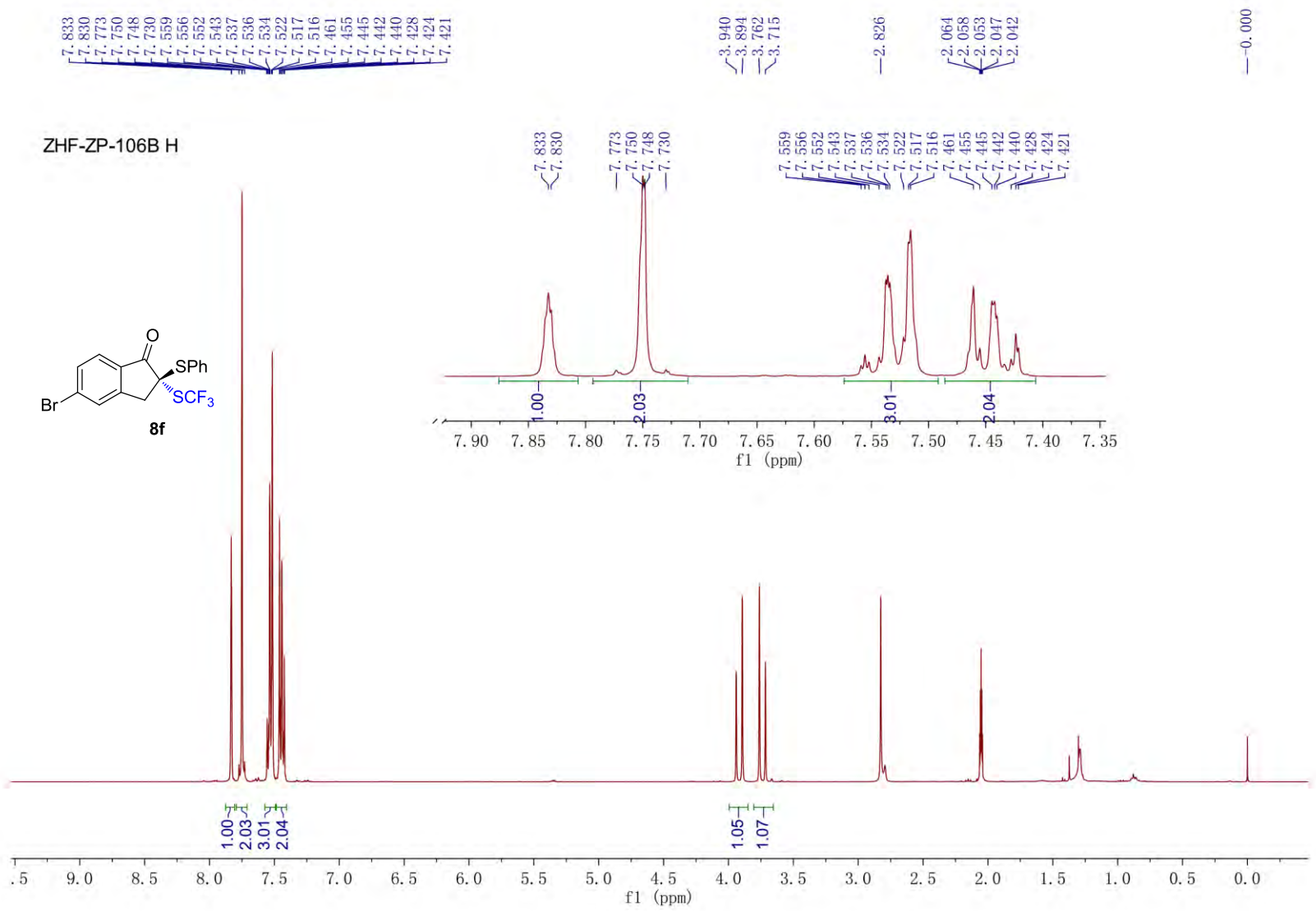

zhf-zp-085 C
194.33
148.37
137.25
135.88
134.08
132.53
130.98
130.73
129.00
128.89
128.62
127.89
126.09
125.77
124.79
77.39
77.07
76.75
64.96
42.95
148.37
137.95
135.88
134.08
132.53
130.98
130.73
129.00
128.89
128.62
127.89
126.09
125.77
124.79
148
137
135
133
131
129
127
125
f1 (ppm)
O
SPh
SCF3
8d
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

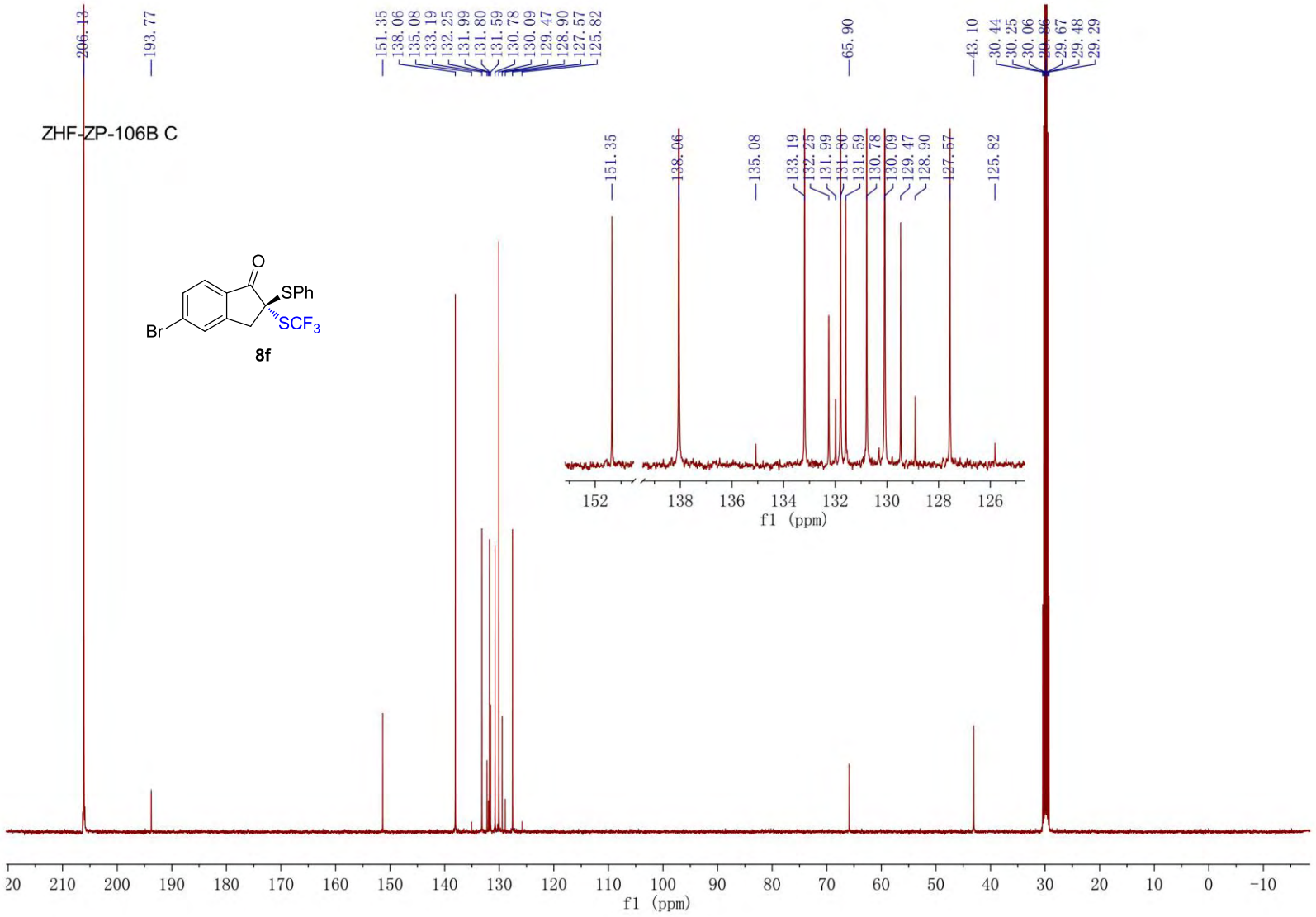

zhf-zp-085 F
-37.145
O
SPh
SCF3
8d
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210
f1 (ppm)

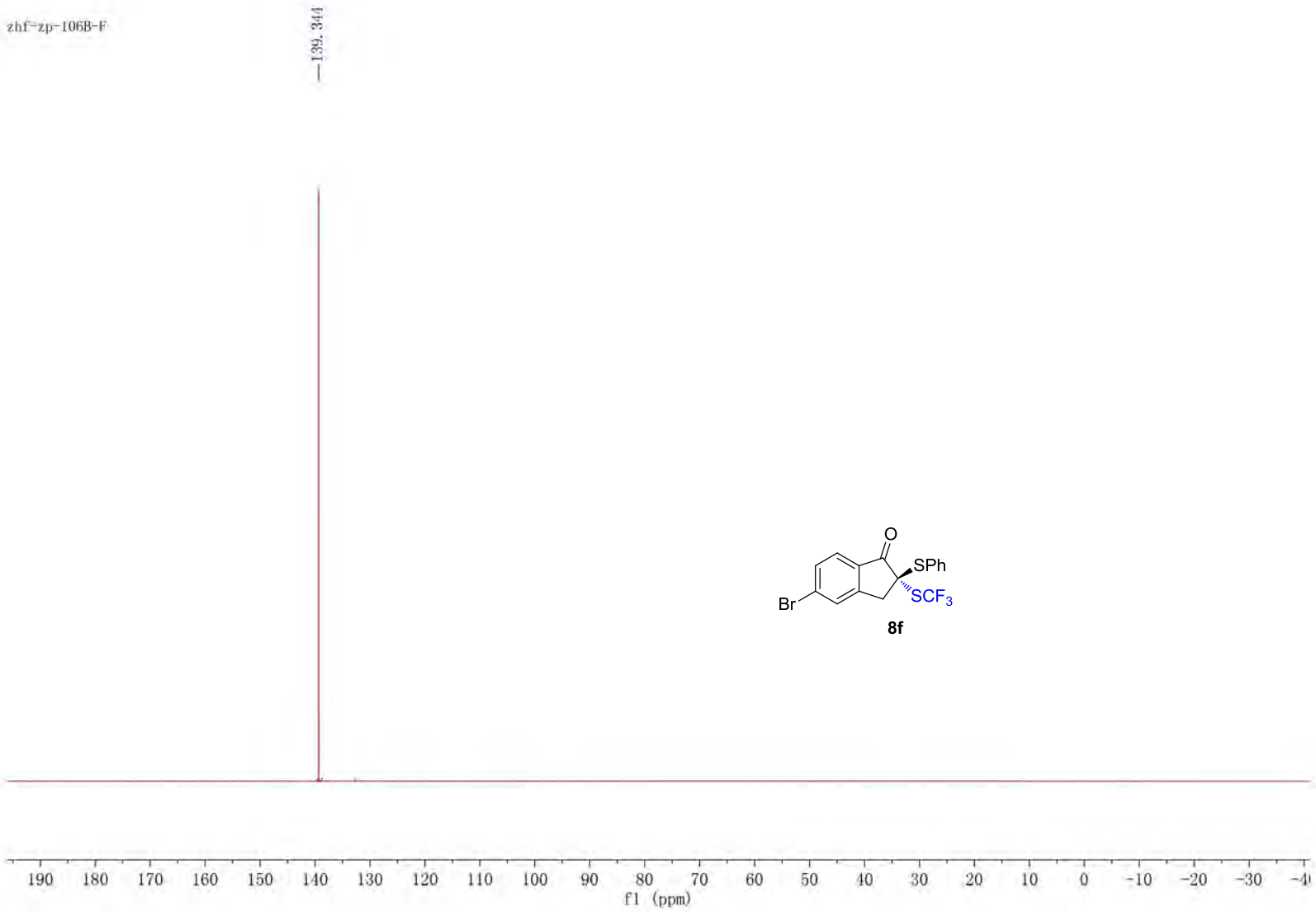

zhf-zq-016 H
8.001
7.999
7.982
7.979
7.854
7.854
7.836
7.835
7.572
7.562
7.558
7.552
7.546
7.540
7.535
7.533
7.531
7.528
7.525
7.522
7.519
7.513
7.508
7.504
7.467
7.462
7.457
7.446
7.444
7.442
7.429
7.425
7.423
3.805
3.759
3.623
3.577
2.858
2.065
2.059
2.054
2.048
2.043
1.00
1.00
4.07
2.07
1.06
1.07
f1 (ppm)
O
SPh
SCF3
Br
8e


zhf-zq-01-C
206.19
193.96
148.74
139.75
138.10
135.47
135.05
131.94
131.89
130.15
129.26
128.87
125.79
125.30
121.86
65.68
44.31
30.46
30.27
30.08
29.89
29.69
29.50
29.31
f1 (ppm)
O
SPh
SCF3
Br
8e

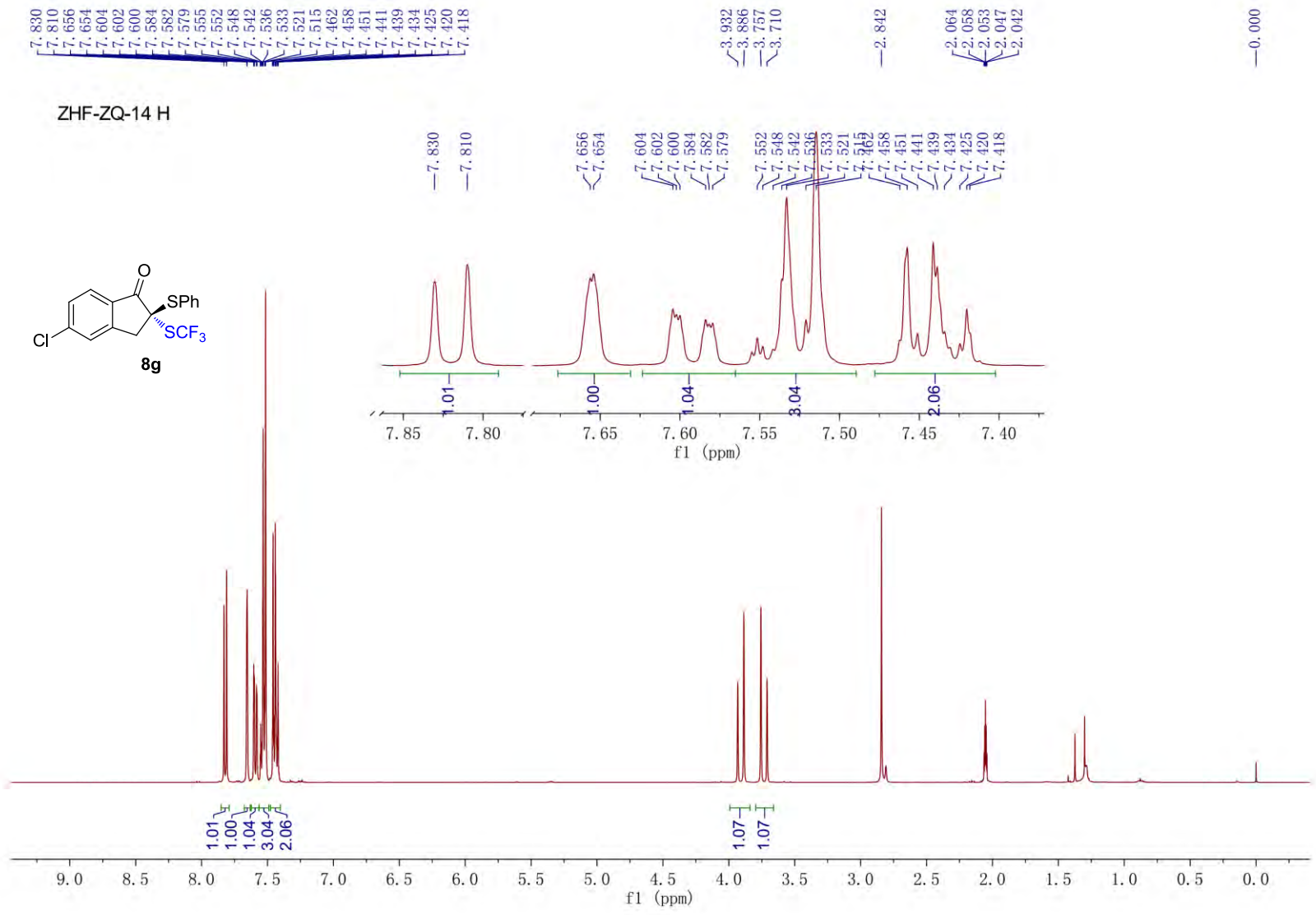

zhf-zq-016-F
-139.460
O
SPh
SCF3
Br
8e
156
154
152
150
148
146
144
142
140
138
136
134
132
130
128
126
124
f1 (ppm)

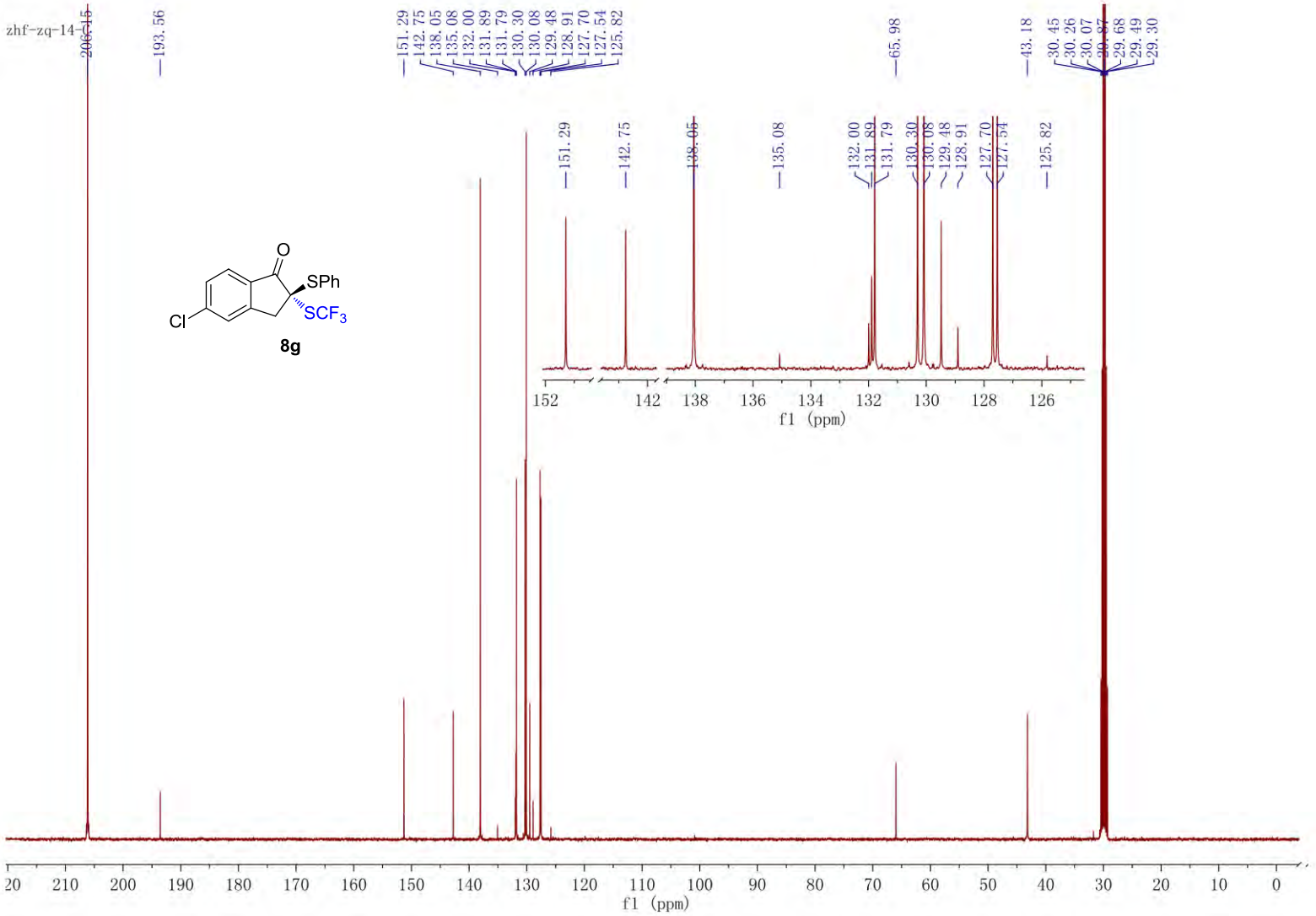

ZHF-ZP-106B H
7.833
7.830
7.773
7.750
7.748
7.730
7.559
7.556
7.552
7.543
7.537
7.536
7.534
7.522
7.517
7.516
7.461
7.455
7.445
7.442
7.440
7.428
7.424
7.421
3.940
3.894
3.762
3.715
2.826
2.064
2.058
2.053
2.047
2.042
0.000
O
SPh
SCF3
Br
8f
1.00
2.03
3.01
2.04
1.05
1.07
f1 (ppm)

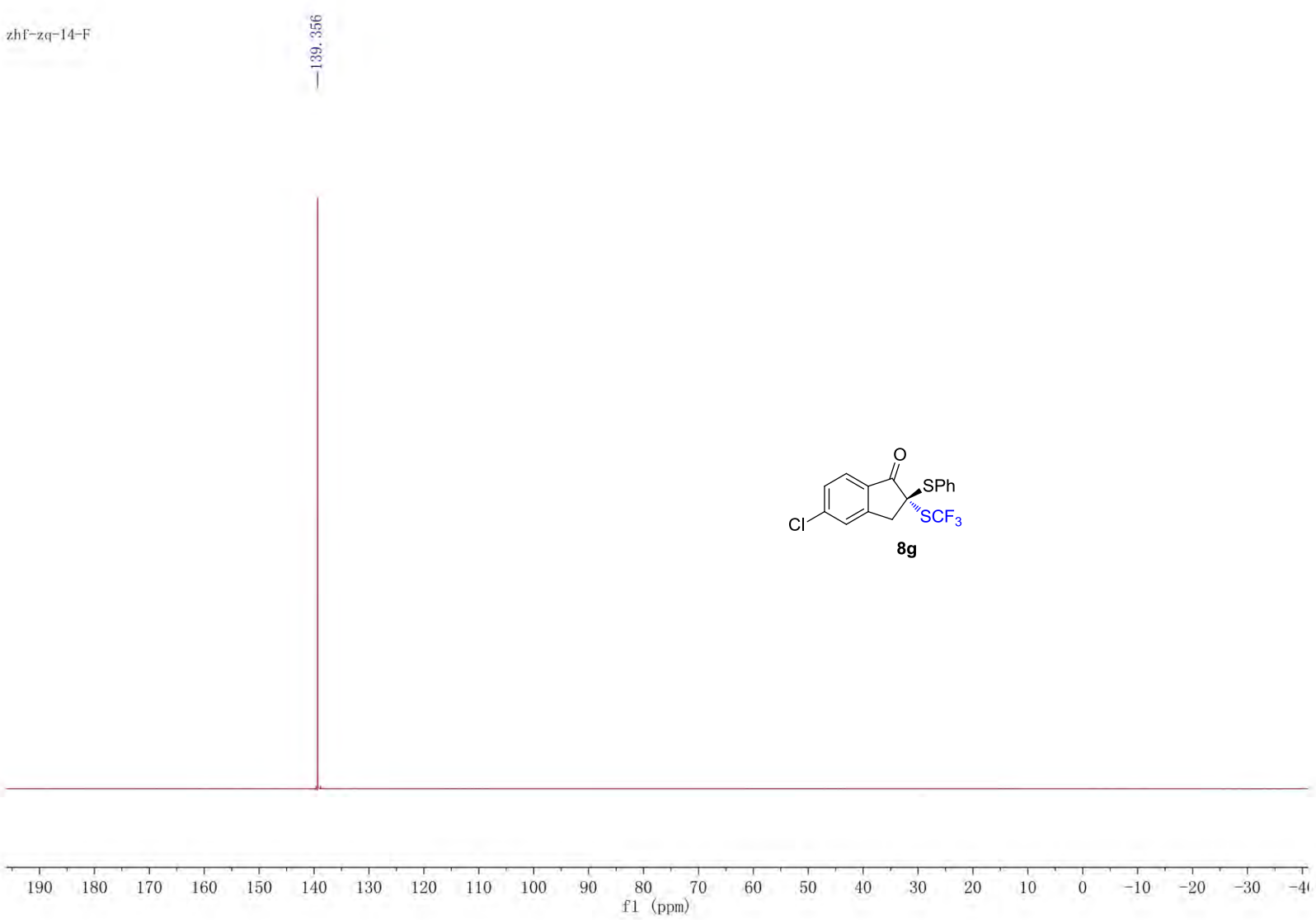

ZHF-ZP-106B C
206.13
193.77
151.35
138.06
135.08
133.19
132.25
131.99
131.80
131.59
130.78
130.09
129.47
128.90
127.57
125.82
65.90
43.10
30.44
30.25
30.06
29.67
29.48
29.29
O
SPh
SCF3
Br
8f
f1 (ppm)

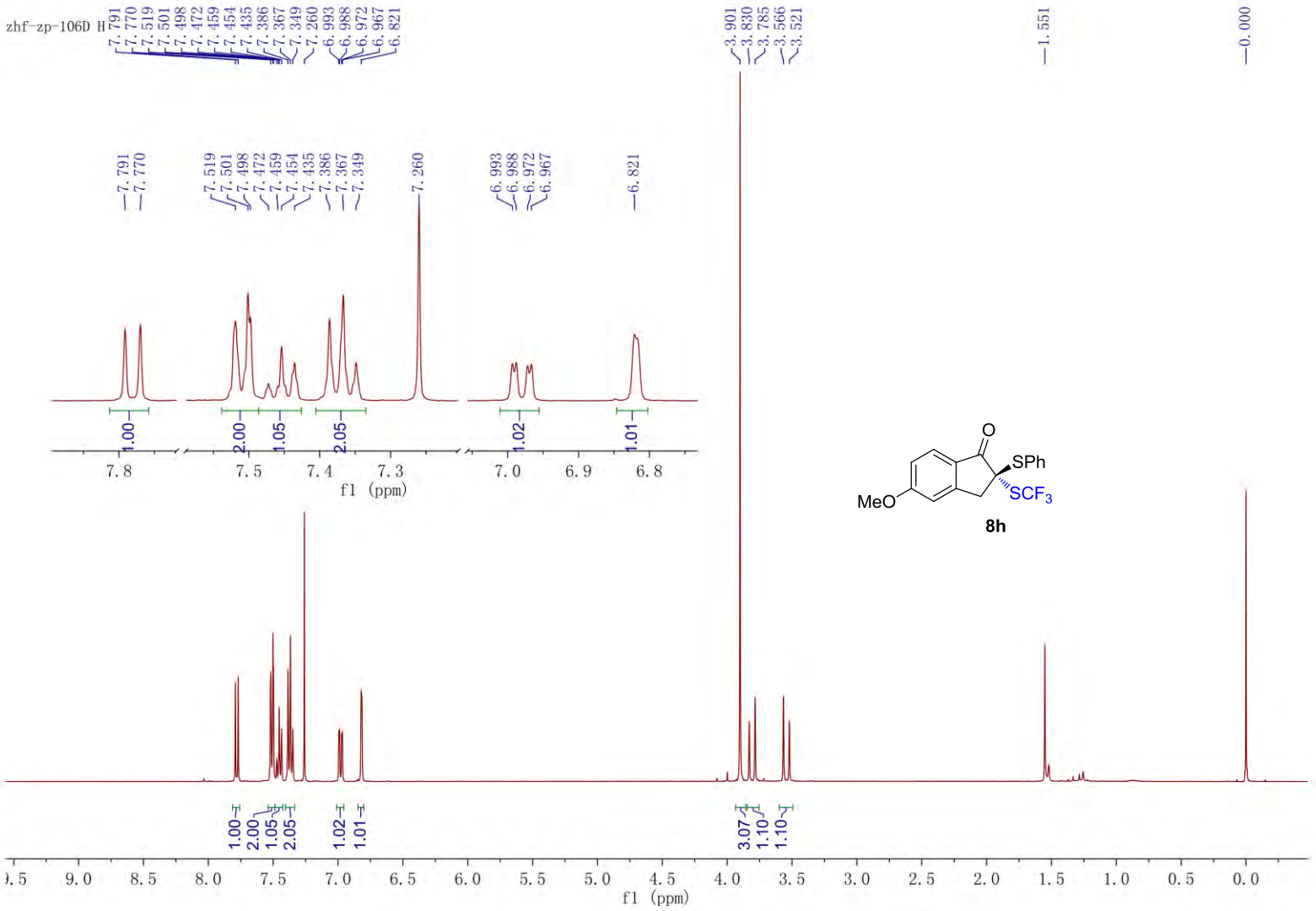

zhf-zp-106B-F
-139.344
O
SPh
SCF3
Br
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30
f1 (ppm)

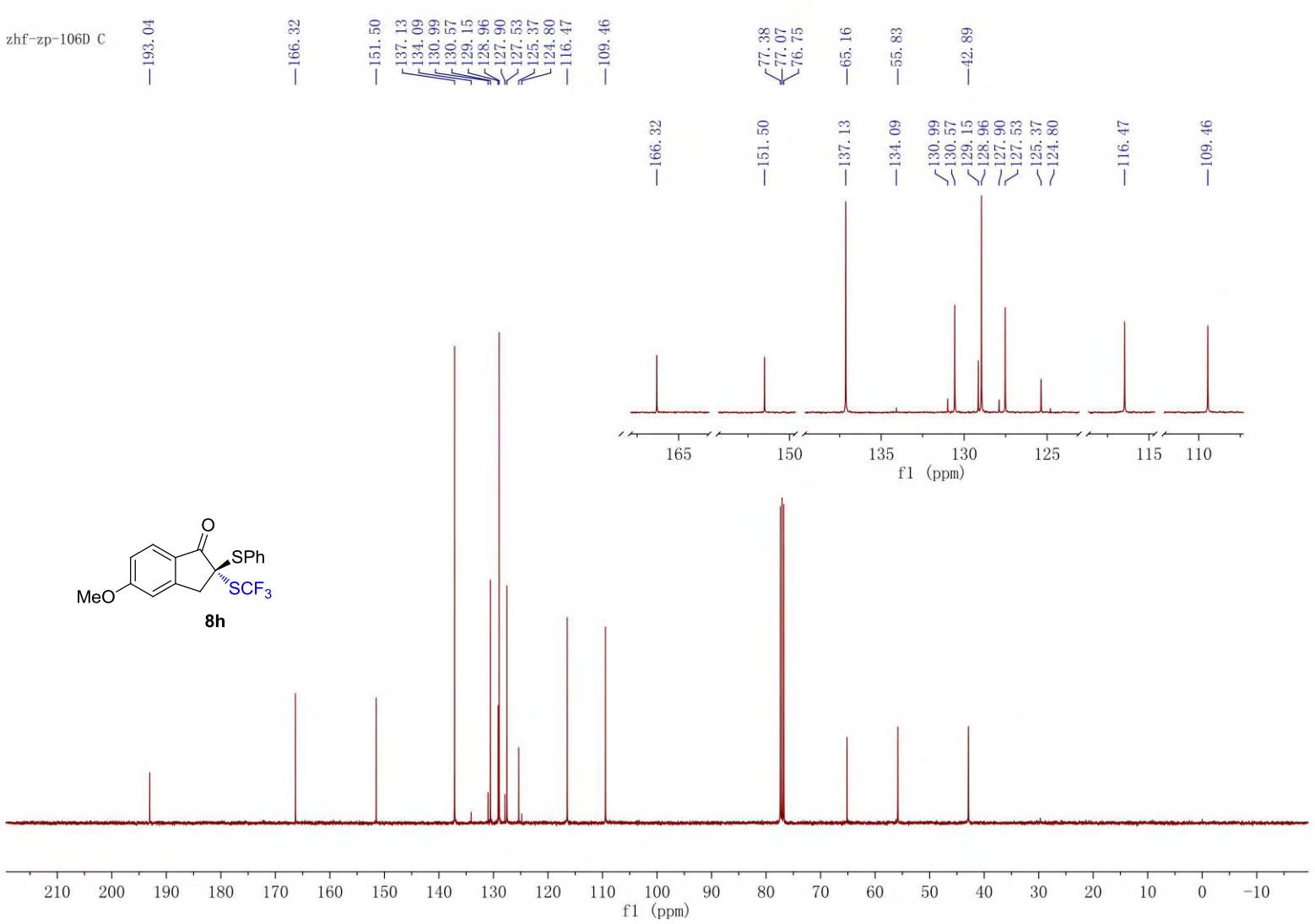
**8f**

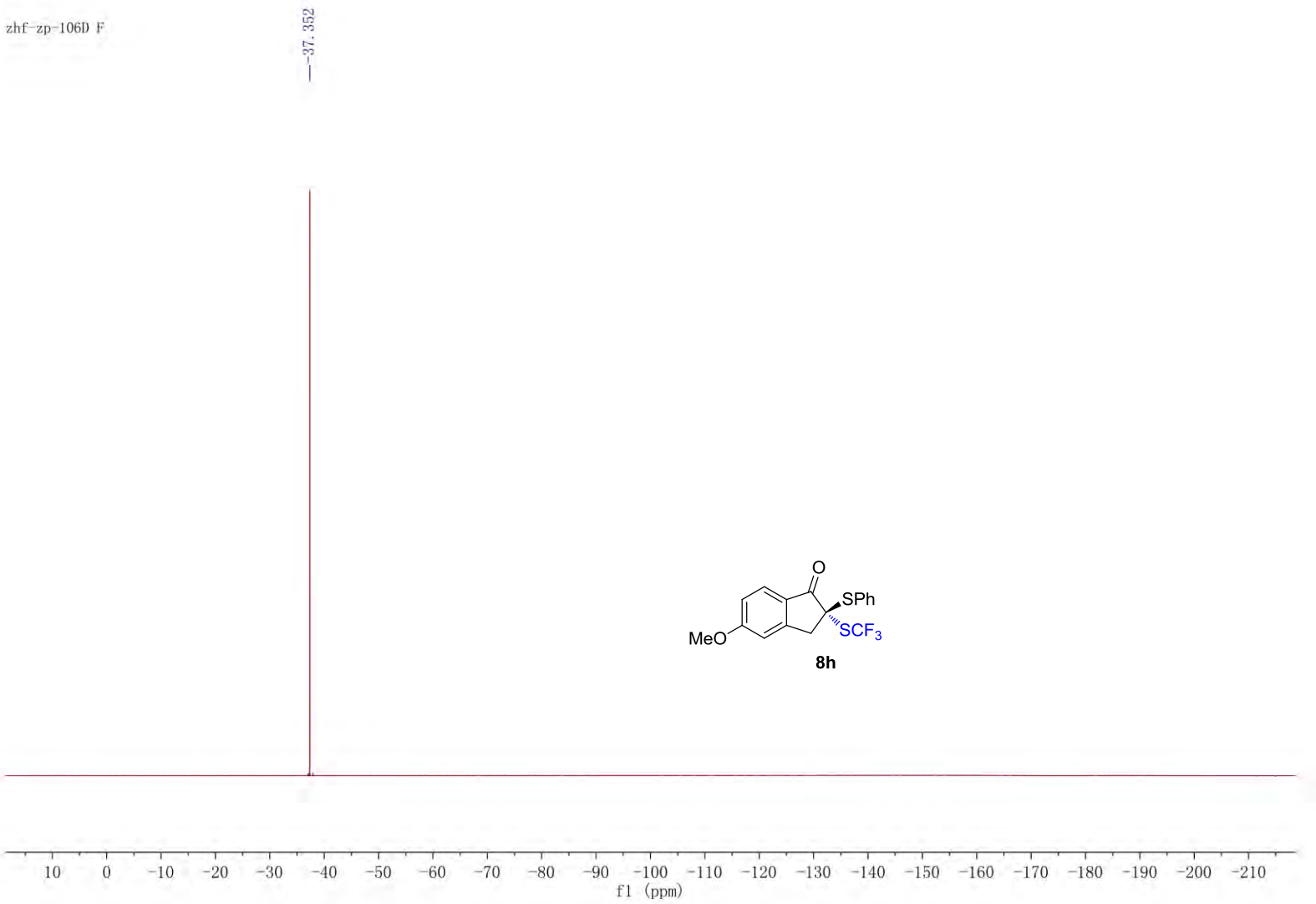

ZHF-ZQ-14 H
7.830
7.810
7.656
7.654
7.604
7.602
7.600
7.584
7.582
7.579
7.552
7.548
7.542
7.536
7.533
7.521
7.515
7.462
7.458
7.451
7.441
7.439
7.434
7.425
7.420
7.418
3.932
3.886
3.757
3.710
2.842
2.064
2.058
2.053
2.047
2.042
0.000
O
SPh
SCF3
Cl
8g
1.01
1.00
1.04
3.04
2.06
1.07
1.07
f1 (ppm)


zhf-zq-14-c
206.15
193.56
151.29
142.75
138.05
135.08
132.00
131.89
131.79
130.30
130.08
129.48
128.91
127.70
127.54
125.82
65.98
43.18
30.45
30.26
30.07
29.87
29.68
29.49
29.30
O
SPh
SCF3
Cl
8g
f1 (ppm)
f1 (ppm)

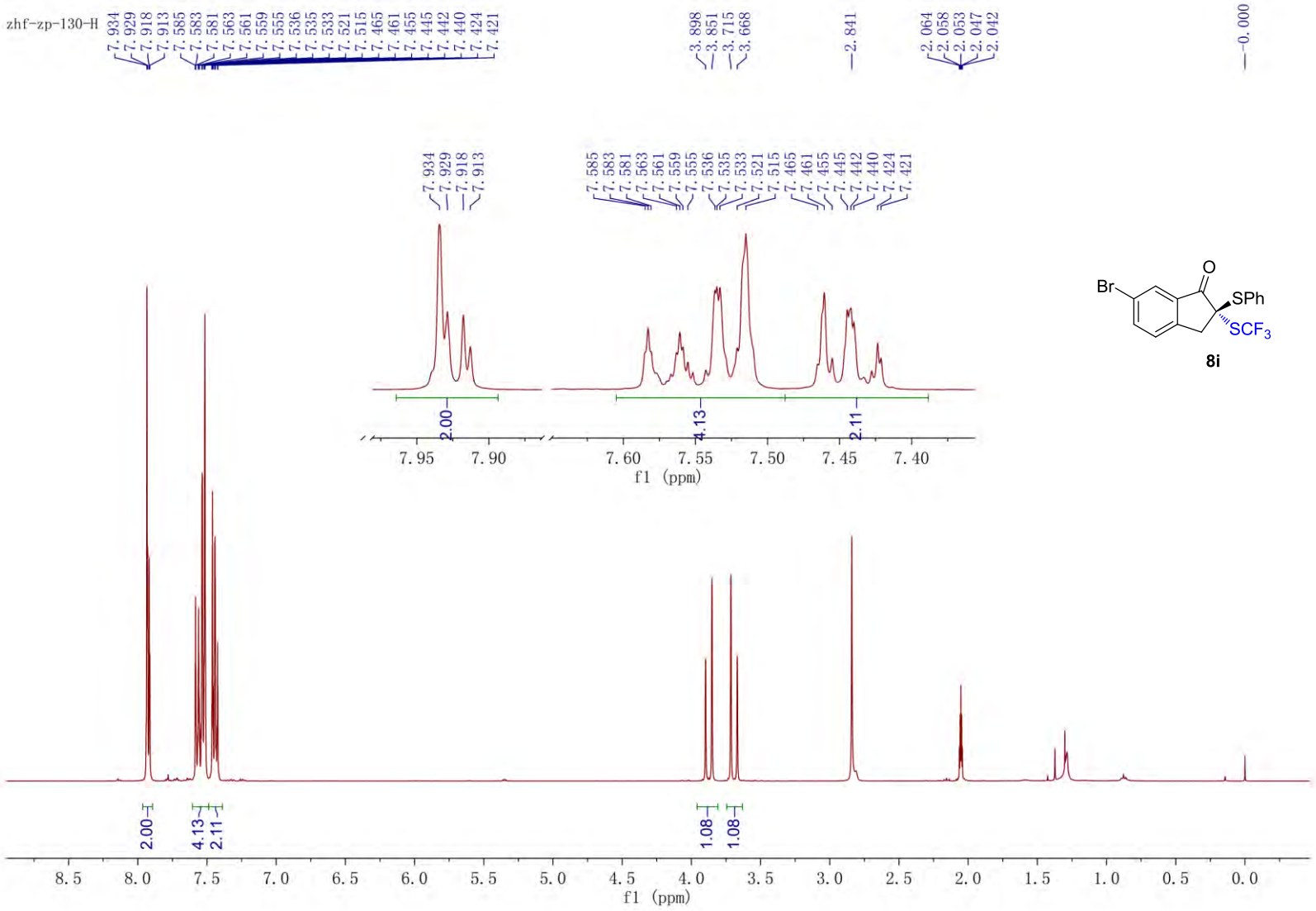

zhf-zq-14-F
-139.356
O
SPh
SCF3
Cl
8g
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30 -4
f1 (ppm)

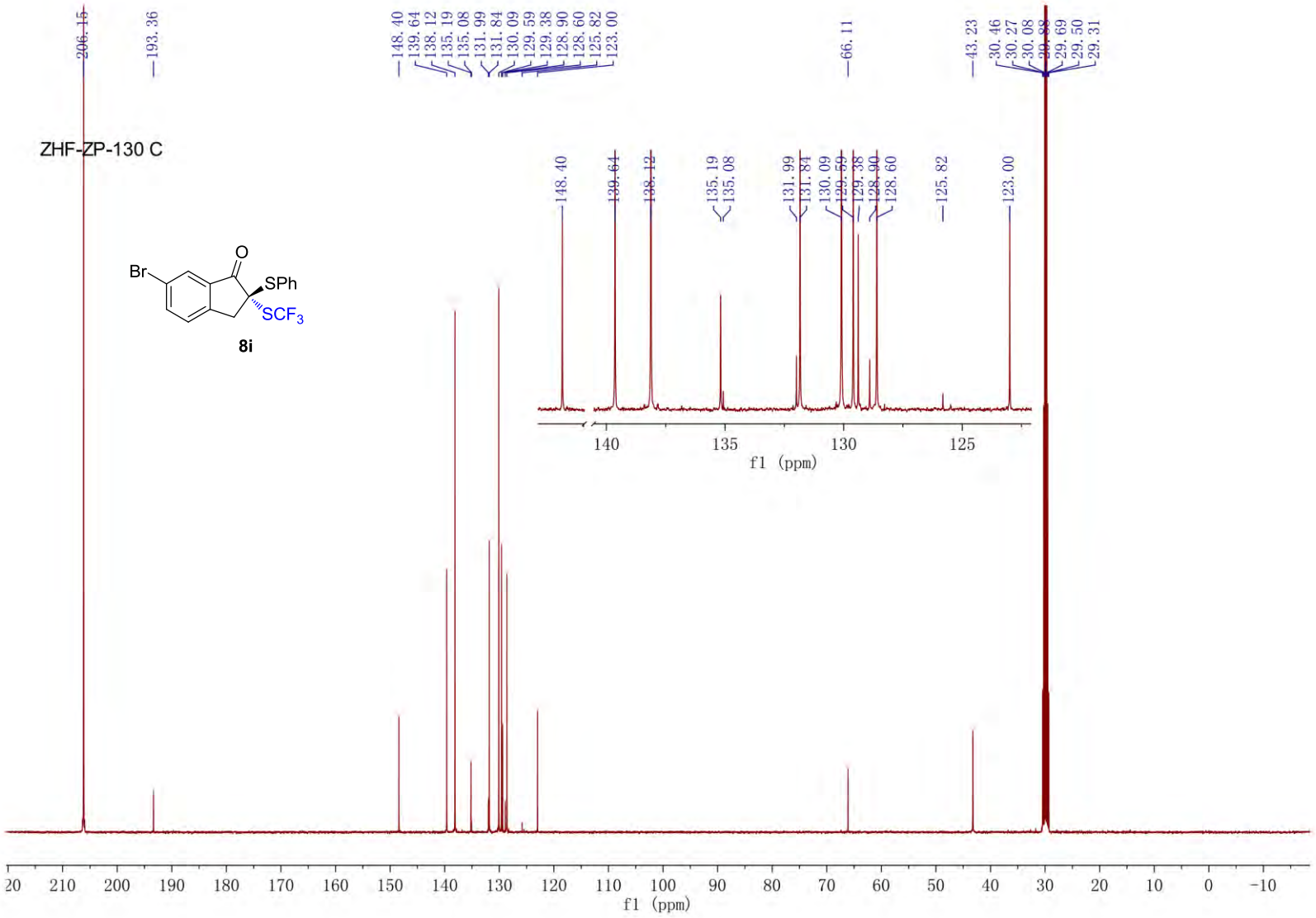

zhf-zp-106D H
7.791
7.770
7.519
7.501
7.498
7.472
7.459
7.454
7.435
7.386
7.367
7.349
7.260
6.993
6.988
6.972
6.967
6.821
3.901
3.830
3.785
3.566
3.521
1.551
0.000
1.00
2.00
1.05
2.05
1.02
1.01
3.07
1.10
1.10
f1 (ppm)
O
SPh
SCF3
MeO
8h


zhf-zp-106D C
193.04
166.32
151.50
137.13
134.09
130.99
130.57
129.15
128.96
127.90
127.53
125.37
124.80
116.47
109.46
77.38
77.07
76.75
65.16
55.83
42.89
MeO
SPh
SCF3
8h
f1 (ppm)


zhf-zp-106D F
-37.352
O
SPh
SCF3
MeO
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210
f1 (ppm)

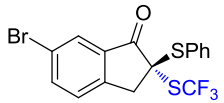
**8h**


zhf-zp-130-H
7.934
7.929
7.918
7.913
7.585
7.583
7.581
7.563
7.561
7.559
7.555
7.536
7.535
7.533
7.521
7.515
7.465
7.461
7.455
7.445
7.442
7.440
7.424
7.421
3.898
3.851
3.715
3.668
2.841
2.064
2.058
2.053
2.047
2.042
0.000
2.00
4.13
2.11
1.08
1.08
f1 (ppm)
Br
O
SPh
SCF3
8i

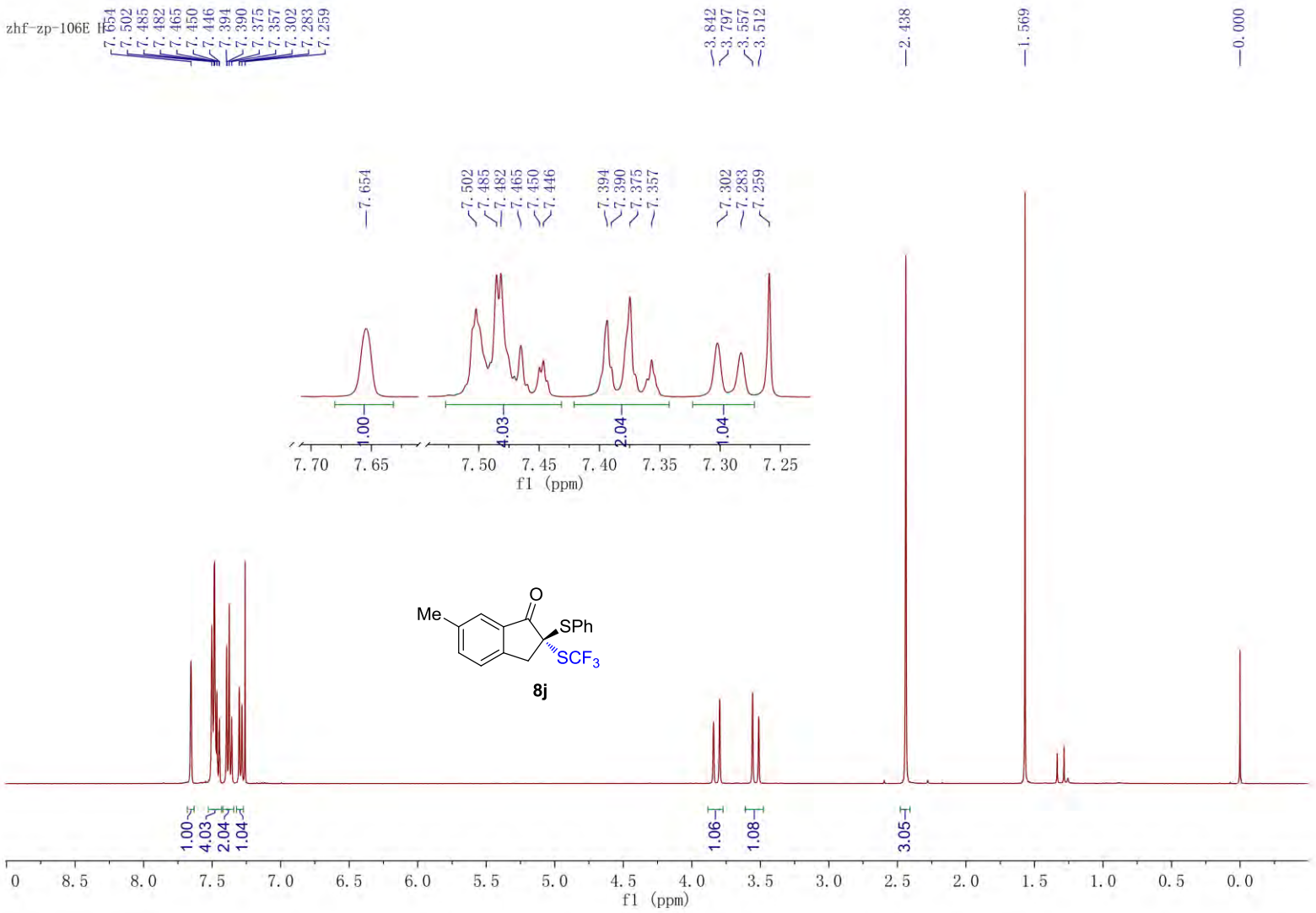

ZHF-ZP-130 C
206.16
193.36
148.40
139.64
138.12
135.19
135.08
131.99
131.84
130.09
129.59
129.38
128.90
128.60
125.82
123.00
66.11
43.23
30.46
30.27
30.08
29.69
29.50
29.31
Br
O
SPh
SCF3
8i
f1 (ppm)

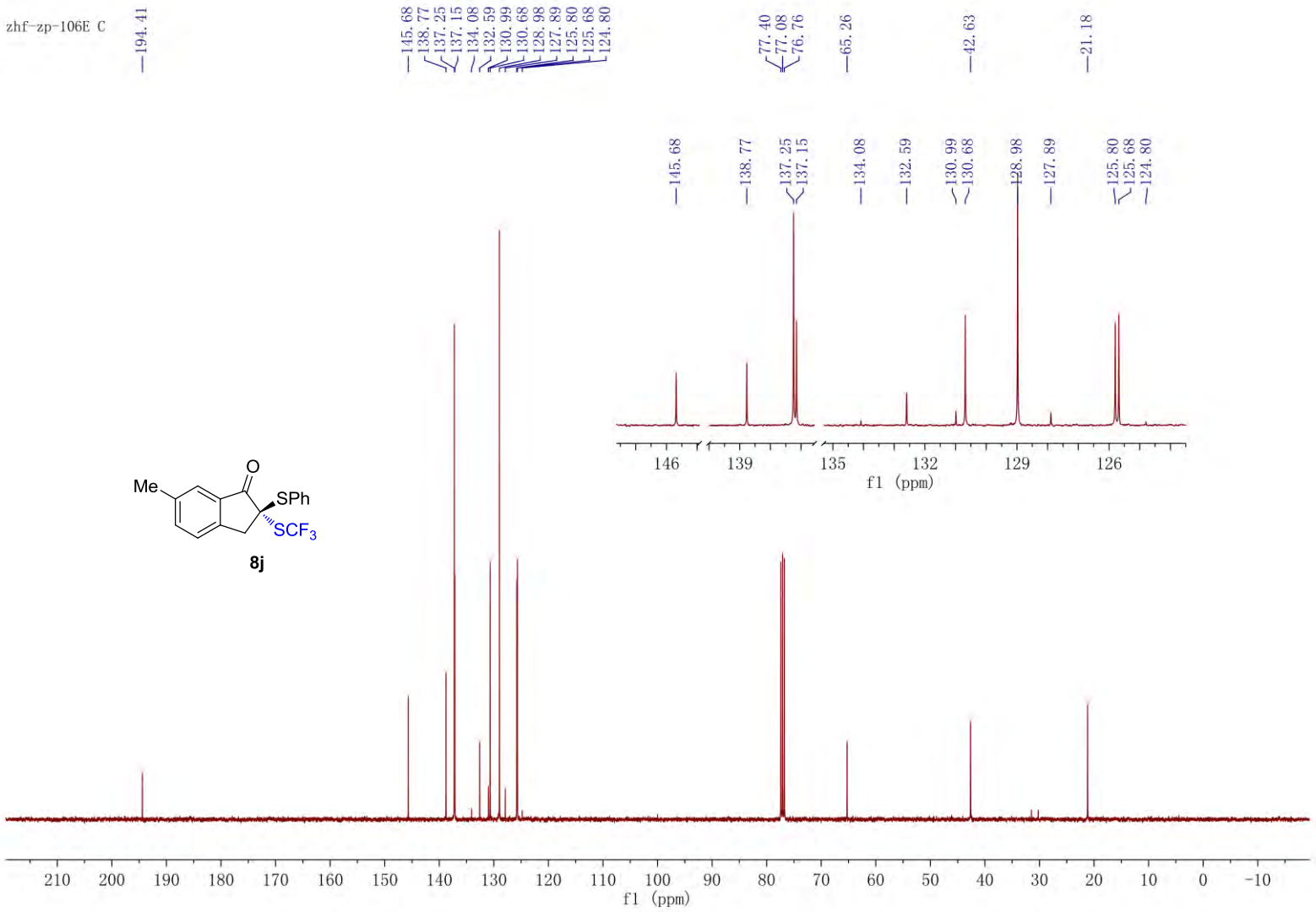
zhf-zp-130-F

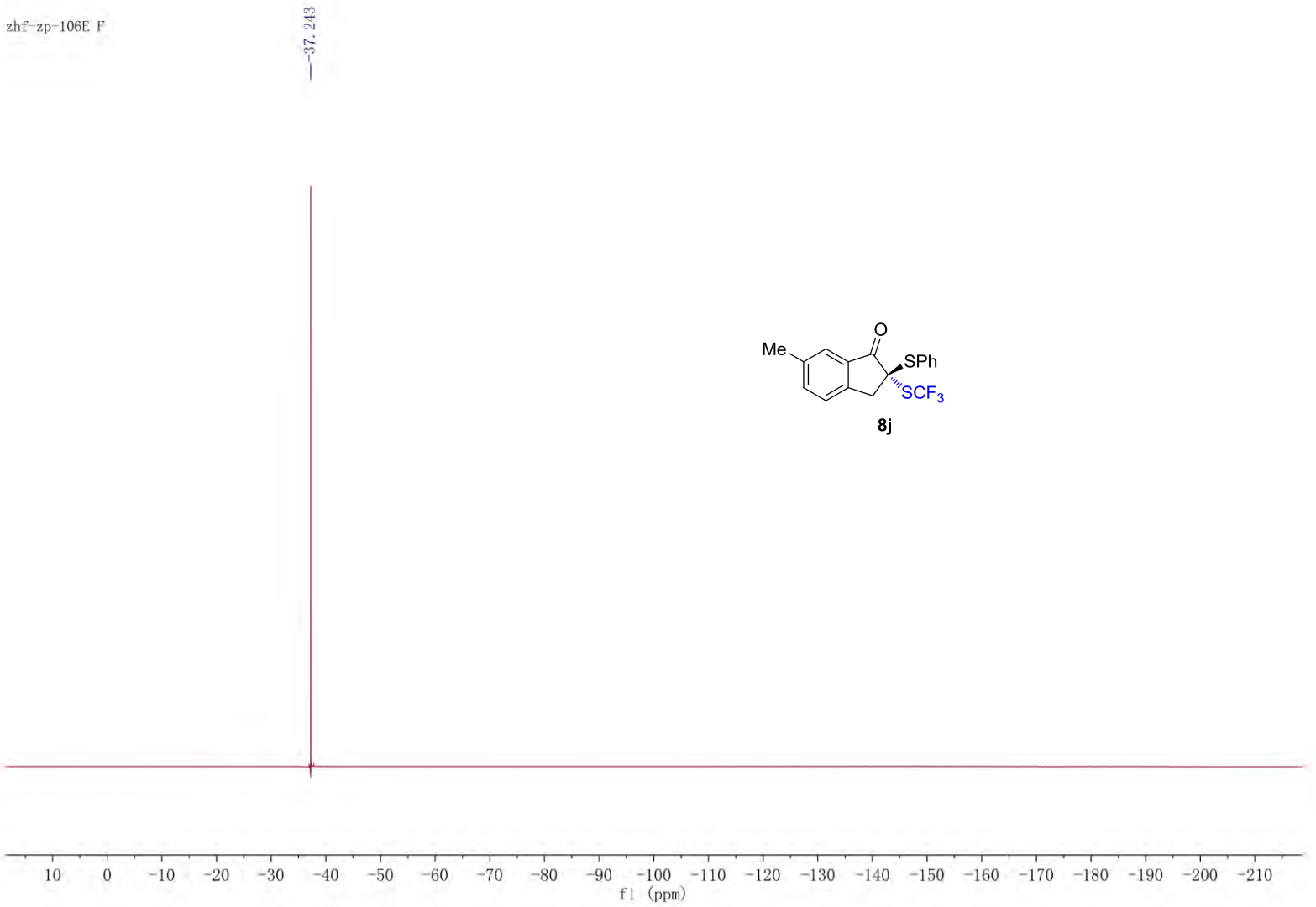
-139.424

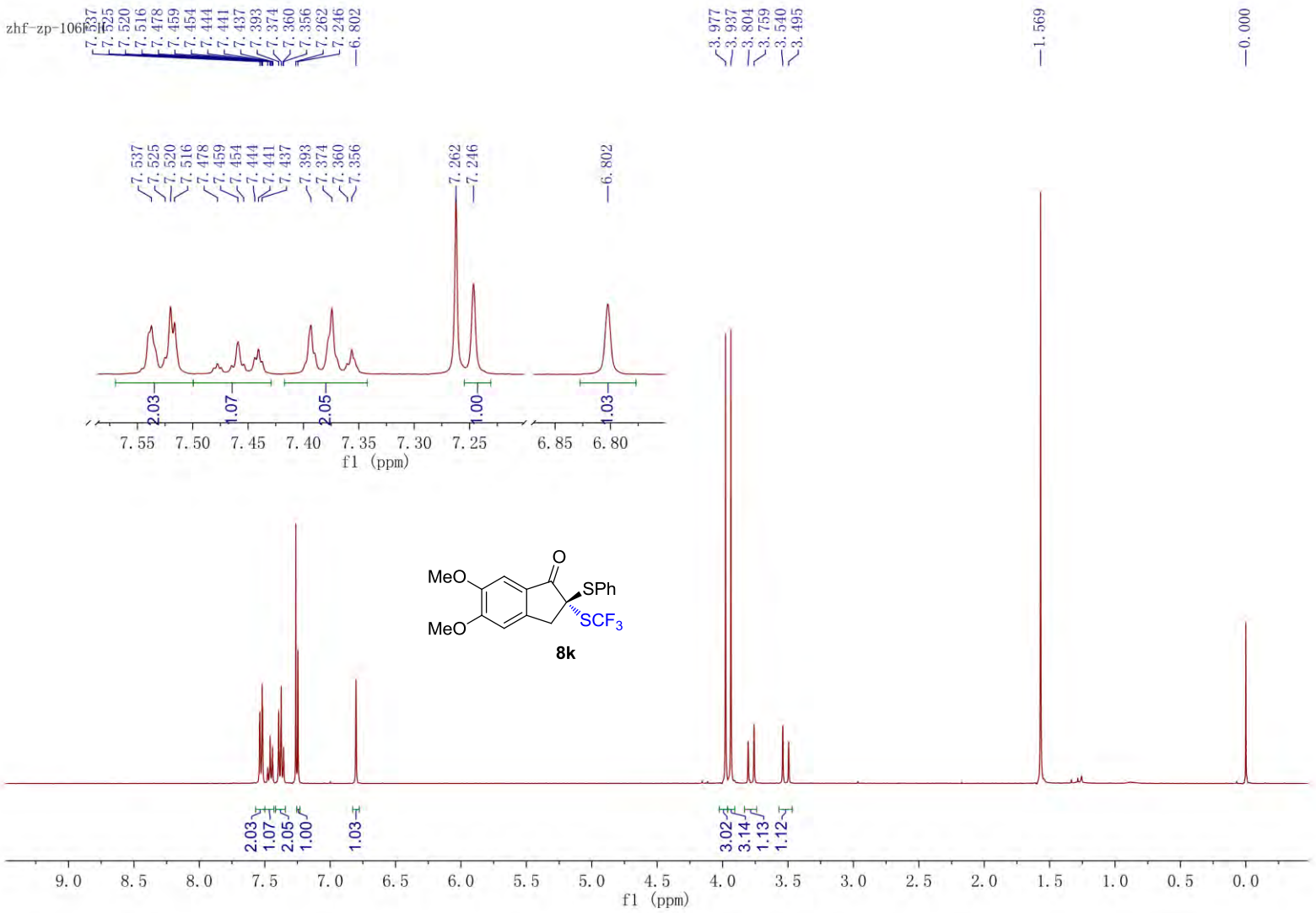


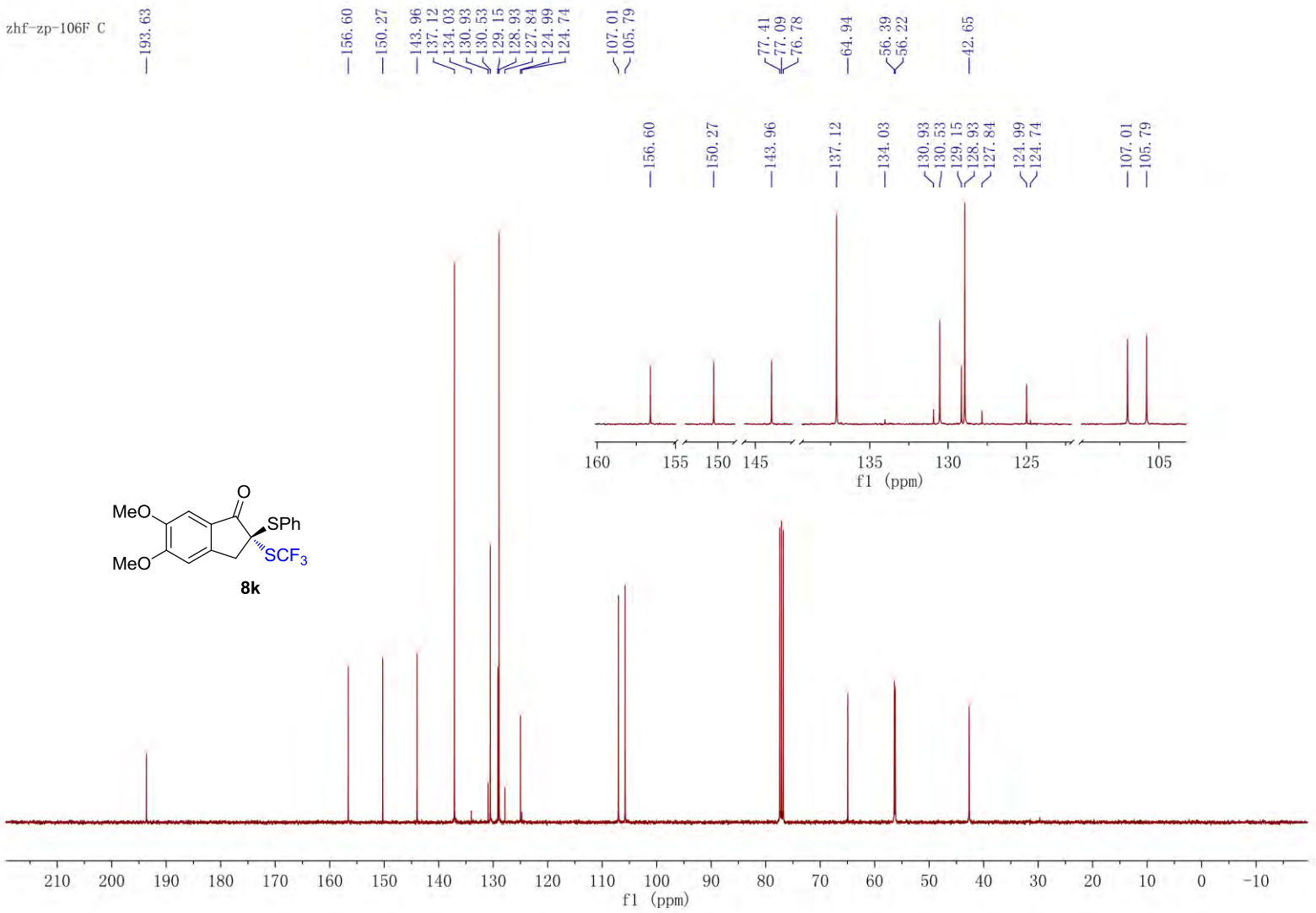

**8i**

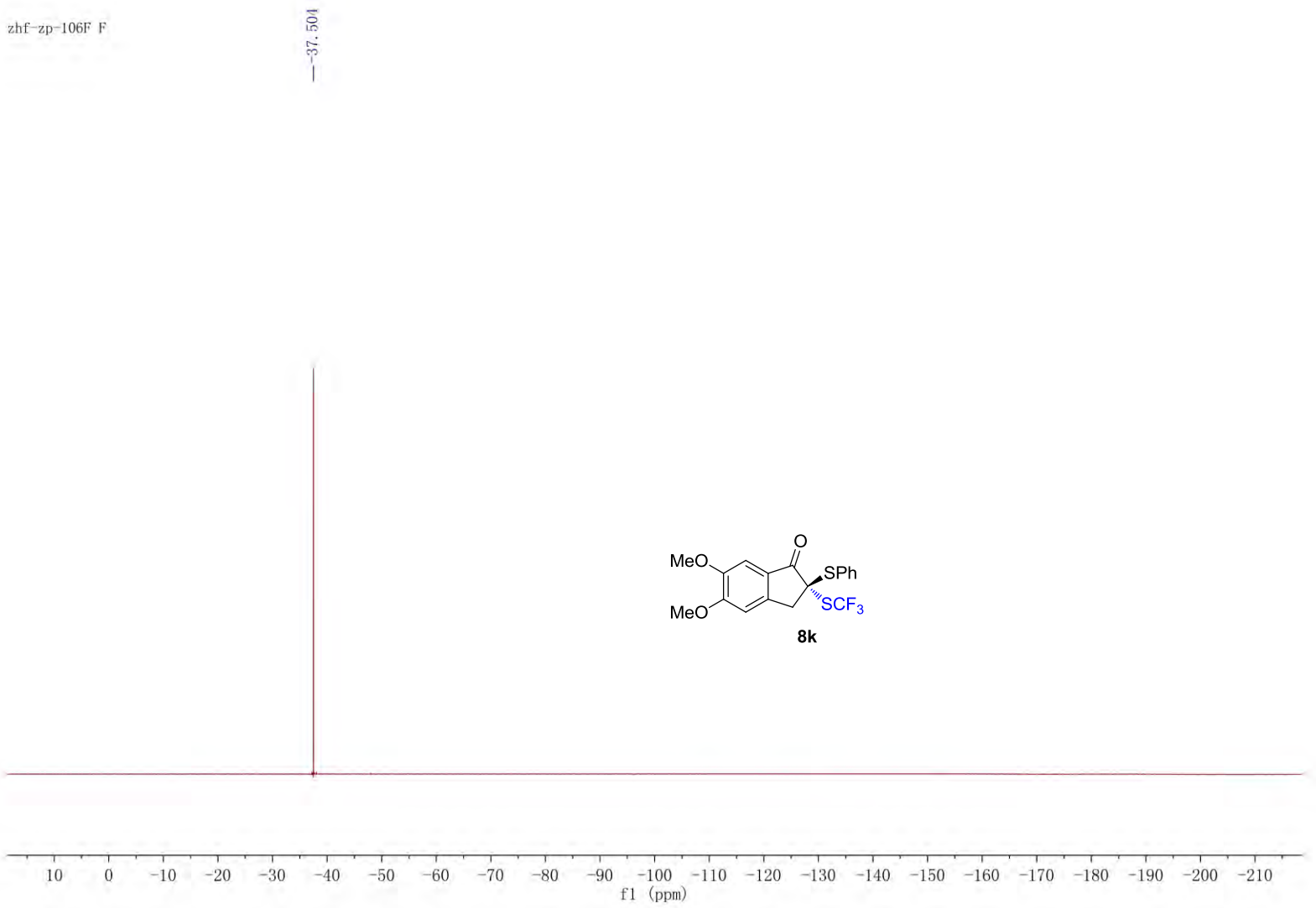

zhf-zp-106E H
7.654
7.502
7.485
7.482
7.465
7.450
7.446
7.394
7.390
7.375
7.357
7.302
7.283
7.259
3.842
3.797
3.557
3.512
2.438
1.569
0.000
1.00
4.03
2.04
1.04
1.06
1.08
3.05
f1 (ppm)
Me
O
SPh
SCF3
8j

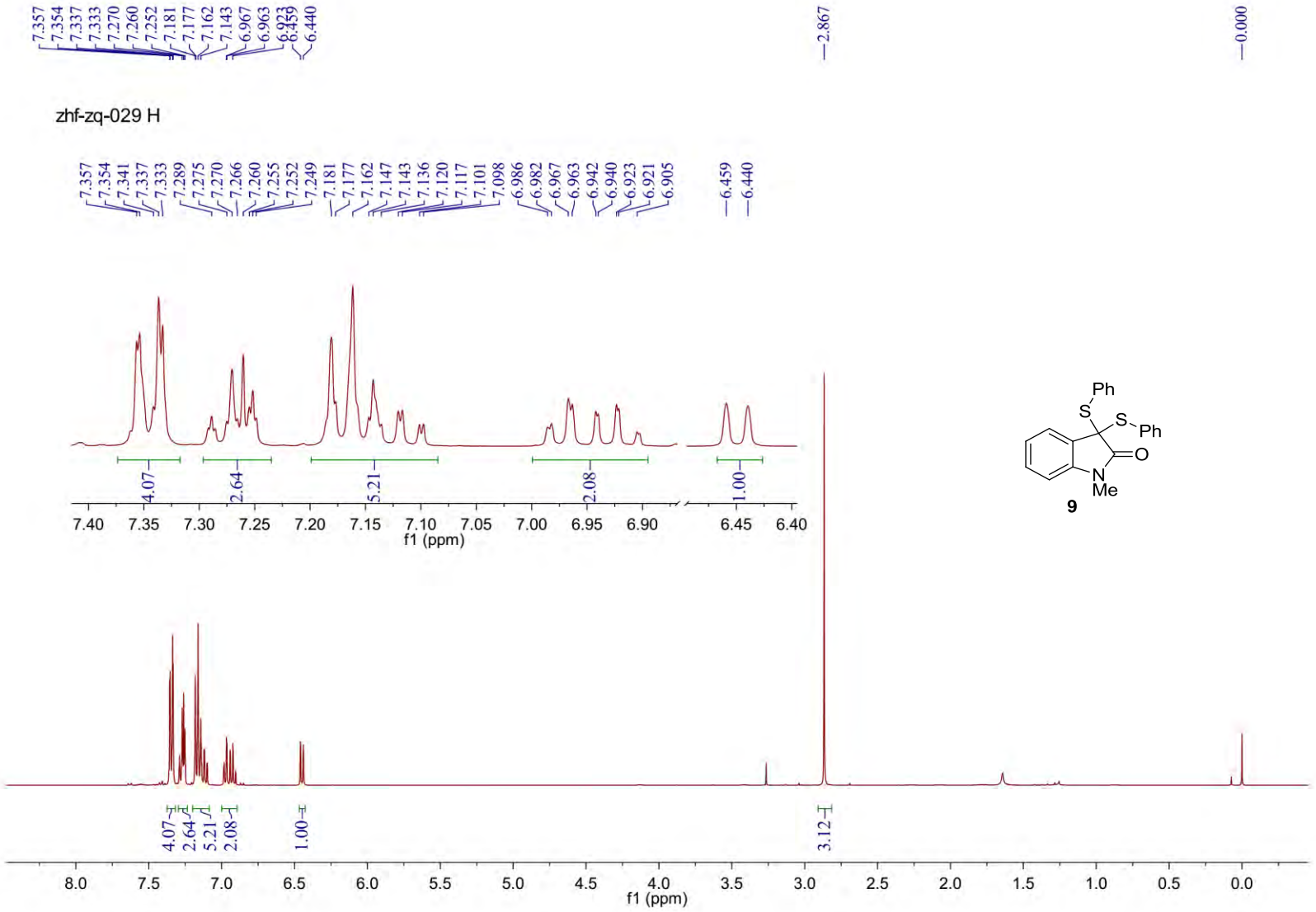

zhf-zp-106E C
194.41
145.68
138.77
137.25
137.15
134.08
132.59
130.99
130.68
128.98
127.89
125.80
125.68
124.80
77.40
77.08
76.76
65.26
42.63
21.18
Me
O
SPh
SCF3
8j
f1 (ppm)


zhf-zp-106E F
-37.243
Me
O
SPh
SCF3
8j
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210
f1 (ppm)


zhf-zp-1065-1H
7.537
7.525
7.520
7.516
7.478
7.459
7.454
7.444
7.441
7.437
7.393
7.374
7.360
7.356
7.262
7.246
6.802
3.977
3.937
3.804
3.759
3.540
3.495
1.569
0.000
2.03
1.07
2.05
1.00
1.03
7.55 7.50 7.45 7.40 7.35 7.30 7.25
6.85 6.80
f1 (ppm)
MeO
MeO
O
SPh
SCF3
8k
2.03
1.07
2.05
1.00
1.03
3.02
3.14
1.13
1.12
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

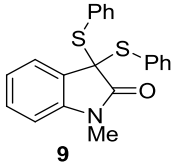

zhf-zp-106F C
193.63
156.60
150.27
143.96
137.12
134.03
130.93
130.53
129.15
128.93
127.84
124.99
124.74
107.01
105.79
77.41
77.09
76.78
64.94
56.39
56.22
42.65
MeO
MeO
O
SPh
SCF3
8k
f1 (ppm)


zhf-zp-106F F
-37.504
MeO
MeO
O
SPh
SCF3
8k
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210
f1 (ppm)


7.357
7.354
7.337
7.333
7.270
7.260
7.252
7.181
7.177
7.162
7.143
6.967
6.963
6.923
6.459
6.440
2.867
0.000
zhf-zq-029 H
7.357
7.354
7.341
7.337
7.333
7.289
7.275
7.270
7.266
7.260
7.255
7.252
7.249
7.181
7.177
7.162
7.147
7.143
7.136
7.120
7.117
7.101
7.098
6.986
6.982
6.967
6.963
6.942
6.940
6.923
6.921
6.905
6.459
6.440
4.07
2.64
5.21
2.08
1.00
7.40 7.35 7.30 7.25 7.20 7.15 7.10 7.05 7.00 6.95 6.90 6.45 6.40
f1 (ppm)
Ph
S
S
Ph
O
N
Me
9
4.07
2.64
5.21
2.08
1.00
3.12
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

zhf-zq-029
zhf-zq-029 C

173.28
142.30
136.71
135.69
129.57
129.30
128.43
128.08
125.52
122.43
107.81
77.36
77.04
76.73
62.81
26.30



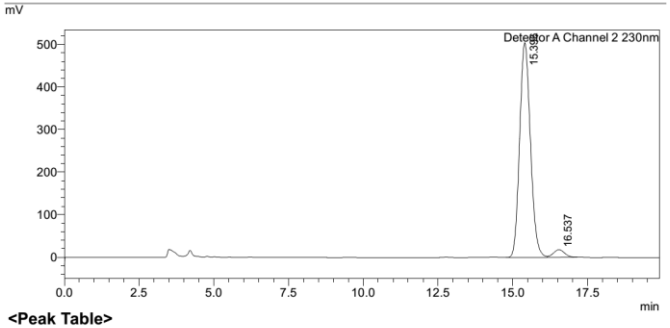

**9**

# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : zhf-zp-011A | | |
| Sample ID | : | | |
| Data Filename | : zhf-zp-011A-asy-ADH-90-10-230-1.0.lcd | | |
| Method Filename | : RUN-1.0.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 5 uL | | |
| Date Acquired | : 2015/4/27 15:03:59 | Acquired by | : System Administrator |
| Date Processed | : 2015/5/1 19:41:18 | Processed by | : System Administrator |

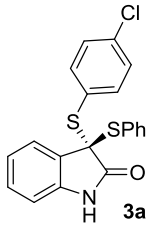
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 15.396 | 12648667 | 504109 | 96.512 |
| 2 | 16.537 | 457088 | 17735 | 3.488 |
| Total | | 13105756 | 521844 | |




**3a**



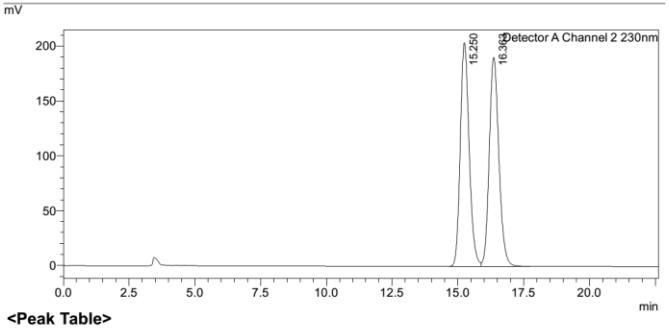


# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : LIK-LA-021 | | |
| Sample ID | : | | |
| Data Filename | : LIK-LA-021-rac-ADH-90-10-230-1.0.lcd | | |
| Method Filename | : RUN-1.0.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 5 uL | | |
| Date Acquired | : 2015/4/27 15:48:55 | Acquired by | : System Administrator |
| Date Processed | : 2015/4/27 16:11:34 | Processed by | : System Administrator |

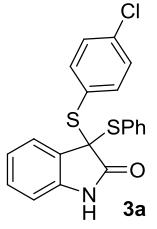
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

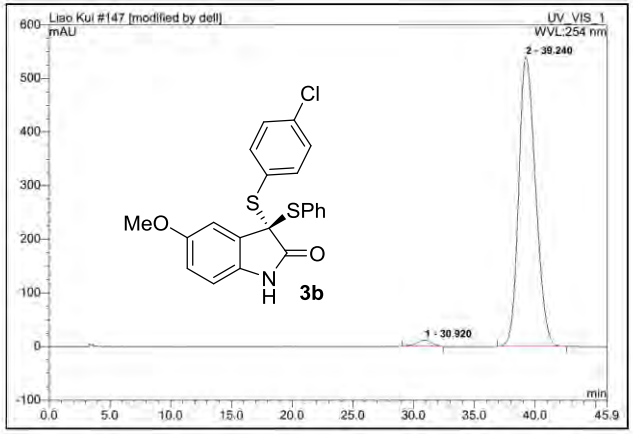
| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 15.250 | 4800165 | 203441 | 49.872 |
| 2 | 16.363 | 4824850 | 190159 | 50.128 |
| Total | | 9625015 | 393601 | |




**3a**

## 147 ZHF-ZP-28-ASY-OZH-97-3-254-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **ZHF-ZP-28-ASY-OZH-97-3-254-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **245** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **254** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-7 16:07** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **45.92** | *Sample Amount:* | **1.0000** |



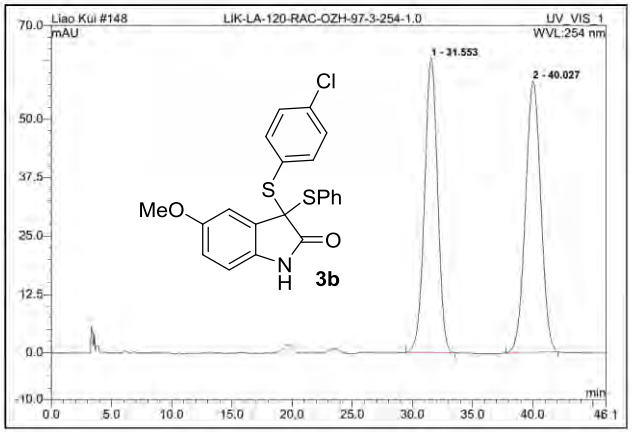

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 30.92 | n.a. | 11.518 | 16.741 | 1.89 | n.a. | BMB* |
| 2 | 39.24 | n.a. | 539.793 | 869.473 | 98.11 | n.a. | BMB* |
| Total: | | | 551.311 | 886.214 | 100.00 | 0.000 | |





## 148 LIK-LA-120-RAC-OZH-97-3-254-1.0

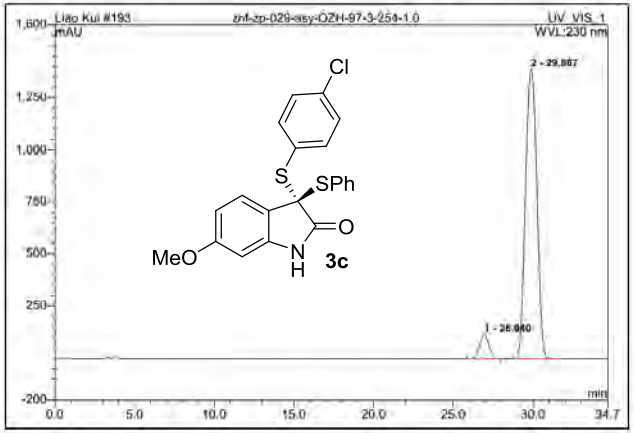
| | | | |
|---|---|---|---|
| *Sample Name:* | **LIK-LA-120-RAC-OZH-97-3-254-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **246** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **254** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-7 16:55** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **46.09** | *Sample Amount:* | **1.0000** |




| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 31.55 | n.a. | 62.897 | 79.213 | 48.01 | n.a. | BMB |
| 2 | 40.03 | n.a. | 57.942 | 85.785 | 51.99 | n.a. | BMB |
| Total: | | | 120.839 | 164.998 | 100.00 | 0.000 | |

## 193 zhf-zp-029-asy-OZH-97-3-254-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-029-asy-OZH-97-3-254-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **291** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-29 19:53** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **34.69** | *Sample Amount:* | **1.0000** |



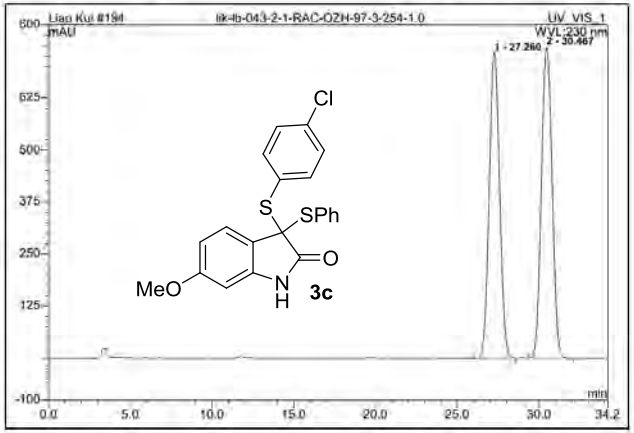

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 26.94 | n.a. | 115.776 | 77.925 | 6.35 | n.a. | BMB |
| 2 | 29.89 | n.a. | 1389.806 | 1148.396 | 93.65 | n.a. | BMB |
| **Total:** | | | 1505.583 | 1226.321 | 100.00 | 0.000 | |





## 194 lik-lb-043-2-1-RAC-OZH-97-3-254-1.0

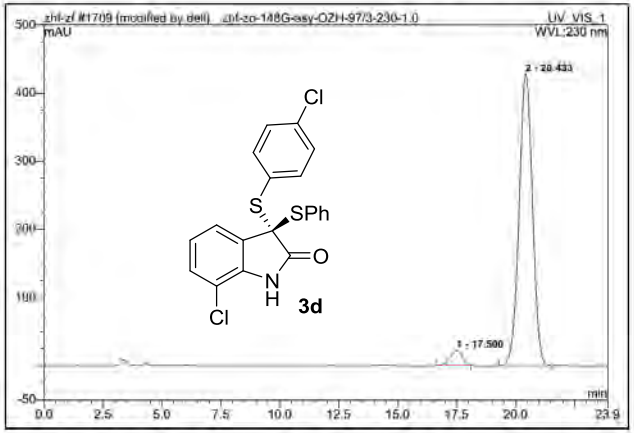
| | | | |
|---|---|---|---|
| *Sample Name:* | **lik-lb-043-2-1-RAC-OZH-97-3-254-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **292** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-29 20:31** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **34.21** | *Sample Amount:* | **1.0000** |




| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 27.26 | n.a. | 732.877 | 539.876 | 48.76 | n.a. | BMB |
| 2 | 30.47 | n.a. | 745.651 | 567.273 | 51.24 | n.a. | BMB |
| **Total:** | | | 1478.528 | 1107.148 | 100.00 | 0.000 | |

## 1709 zhf-zo-148G-asy-OZH-97/3-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zo-148G-asy-OZH-97/3-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **816** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-4-27 14:15** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **23.91** | *Sample Amount:* | **1.0000** |



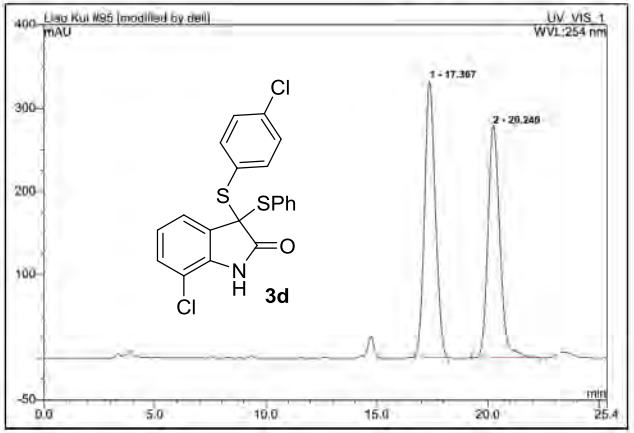

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 17.50 | n.a. | 22.016 | 13.625 | 4.62 | n.a. | BMB* |
| 2 | 20.43 | n.a. | 427.902 | 281.258 | 95.38 | n.a. | BMB* |
| Total: | | | 449.918 | 294.883 | 100.00 | 0.000 | |





## 95 lik-la-122--rac-OZH-97-03-254-1.0

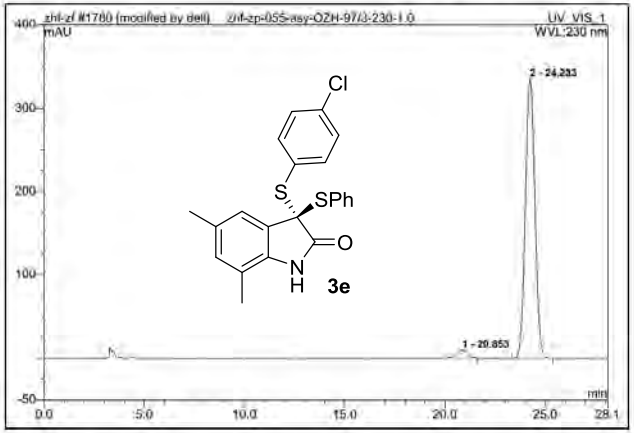
| | | | |
|---|---|---|---|
| *Sample Name:* | **lik-la-122--rac-OZH-97-03-254-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **193** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **254** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-4-8 14:40** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **25.36** | *Sample Amount:* | **1.0000** |




| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 17.37 | n.a. | 331.434 | 186.233 | 51.74 | n.a. | BMB* |
| 2 | 20.24 | n.a. | 278.096 | 173.719 | 48.26 | n.a. | BMB* |
| Total: | | | 609.530 | 359.952 | 100.00 | 0.000 | |

## 1780 zhf-zp-055-asy-OZH-97/3-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-055-asy-OZH-97/3-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **888** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-28 18:58** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **28.11** | *Sample Amount:* | **1.0000** |



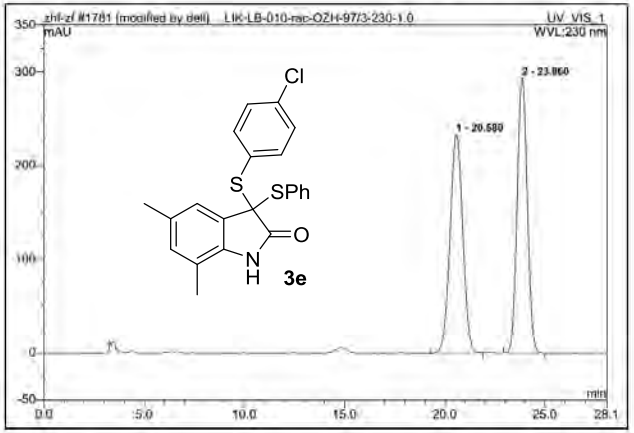

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 20.85 | n.a. | 9.541 | 6.548 | 3.44 | n.a. | BMB* |
| 2 | 24.23 | n.a. | 334.457 | 184.060 | 96.56 | n.a. | BMB* |
| Total: | | | 343.998 | 190.608 | 100.00 | 0.000 | |





## 1781 LIK-LB-010-rac-OZH-97/3-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **LIK-LB-010-rac-OZH-97/3-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **889** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-28 19:27** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **28.09** | *Sample Amount:* | **1.0000** |



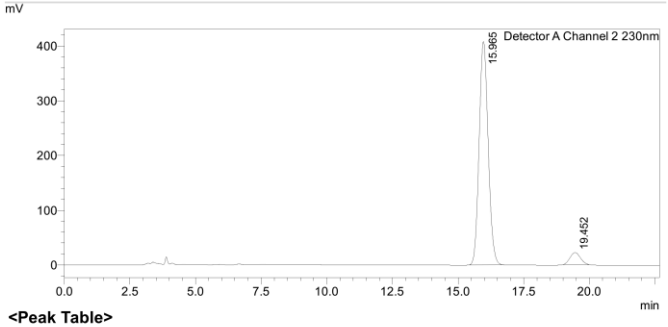

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 20.58 | n.a. | 233.228 | 171.544 | 49.94 | n.a. | BMB |
| 2 | 23.86 | n.a. | 293.772 | 171.984 | 50.06 | n.a. | BMB |
| Total: | | | 527.001 | 343.528 | 100.00 | 0.000 | |

# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : zhf-zq-043 | | |
| Sample ID | : | | |
| Data Filename | : zhf-zq-043-asy-2-ADH-90-10-230-1.8.lcd | | |
| Method Filename | : zry.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/9/3 19:45:34 | Acquired by | : System Administrator |
| Date Processed | : 2015/9/4 11:13:50 | Processed by | : System Administrator |

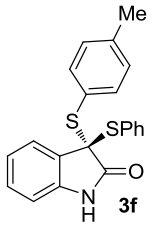
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 15.965 | 9726487 | 407794 | 94.144 |
| 2 | 19.452 | 604958 | 22043 | 5.856 |
| Total | | 10331445 | 429836 | |





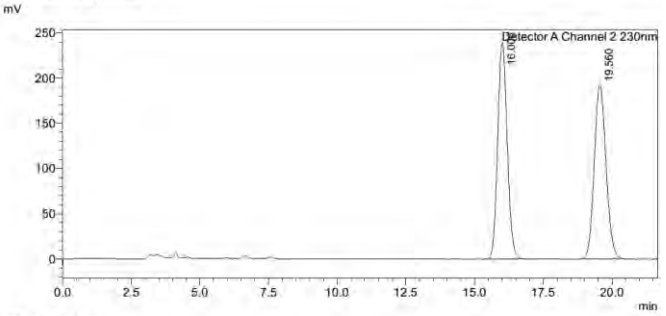



SHIMADZU LabSolutions **Analysis Report**

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : zhf-zq-043 | | |
| Sample ID | : | | |
| Data Filename | : zhf-zq-043-rac-ADH-90-10-230-1.1.lcd | | |
| Method Filename | : zry.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/9/3 16:07:26 | Acquired by | : System Administrator |
| Date Processed | : 2015/9/4 11:14:26 | Processed by | : System Administrator |

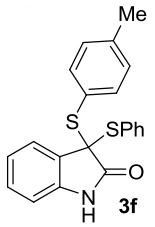
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

| Peak# | Ret. Time | Area | Height | Conc. | Unit | Mark | Name |
|---|---|---|---|---|---|---|---|
| 1 | 16.006 | 5762079 | 239758 | 50.140 | | M | |
| 2 | 19.560 | 5729797 | 192790 | 49.860 | | M | |
| Total | | 11491877 | 432548 | | | | |

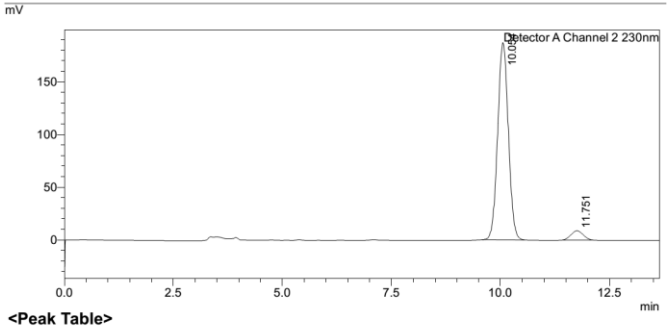


# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : ZHF-ZQ-053 | | |
| Sample ID | : | | |
| Data Filename | : zhf-zq-053-asy-OZH-90-10-230-1.0.lcd | | |
| Method Filename | : chl-0128.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/9/6 13:51:09 | Acquired by | : System Administrator |
| Date Processed | : 2015/9/7 9:26:48 | Processed by | : System Administrator |

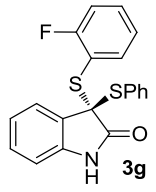
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 10.054 | 3175326 | 186759 | 94.923 |
| 2 | 11.751 | 169841 | 8750 | 5.077 |
| Total | | 3345167 | 195509 | |




**3g**



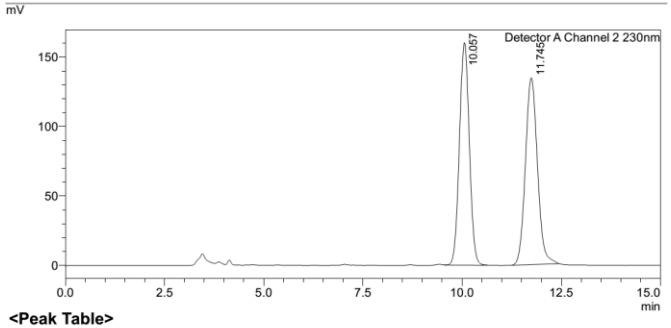


# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : ZHF-ZQ-056A | | |
| Sample ID | : | | |
| Data Filename | : zhf-zq-056A-rac-OZH-90-10-230-1.0.lcd | | |
| Method Filename | : chl-0128.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/9/6 14:05:36 | Acquired by | : System Administrator |
| Date Processed | : 2015/9/7 9:29:00 | Processed by | : System Administrator |

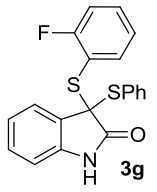
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 10.057 | 2722740 | 160035 | 48.908 |
| 2 | 11.745 | 2844300 | 134440 | 51.092 |
| Total | | 5567040 | 294475 | |



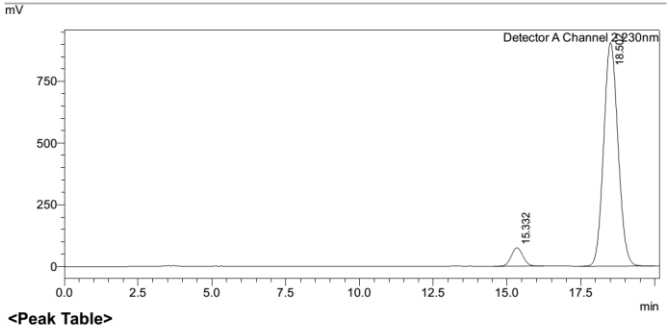

**3g**

# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : zhf-zp-71C-ASY-IC-90-10-230-1.0 | | |
| Sample ID | : | | |
| Data Filename | : zhf-zp-71C-ASY-IC-90-10-230-1.0.lcd | | |
| Method Filename | : RUN-1.0.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/7/18 16:18:57 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/18 17:15:24 | Processed by | : System Administrator |

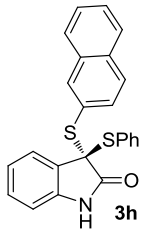
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 15.332 | 2054306 | 74595 | 6.289 |
| 2 | 18.502 | 30608564 | 904672 | 93.711 |
| Total | | 32662870 | 979267 | |




**3h**



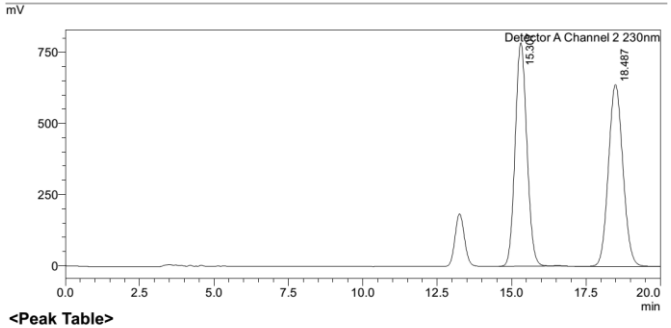


# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : LIK-LB-091-7-RAC-IC-90-10-230-1.0 | | |
| Sample ID | : | | |
| Data Filename | : LIK-LB-091-7-RAC-IC-90-10-230-1.0.lcd | | |
| Method Filename | : RUN-1.0.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/7/18 16:40:06 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/18 22:29:27 | Processed by | : System Administrator |

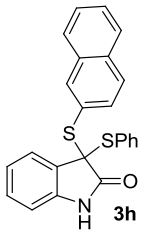
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

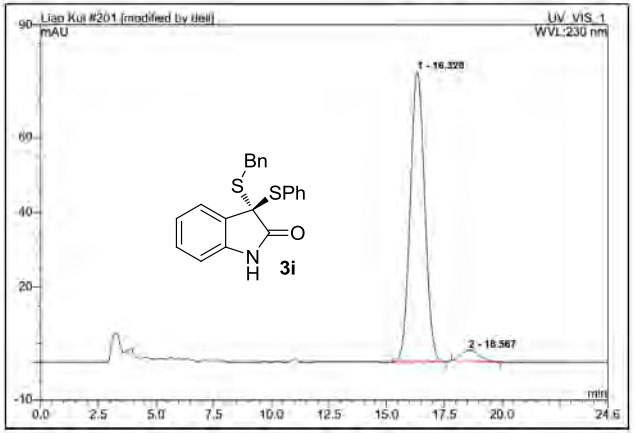
| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 15.307 | 21631578 | 784472 | 50.057 |
| 2 | 18.487 | 21582148 | 638126 | 49.943 |
| Total | | 43213726 | 1422599 | |




**3h**

## 201 zhf-zp-056B-asy-ASH-80-20-254-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-056B-asy-ASH-80-20-254-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **299** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-30 10:38** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **24.58** | *Sample Amount:* | **1.0000** |



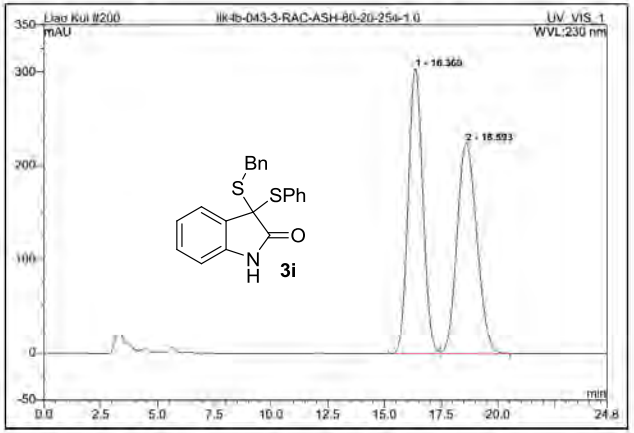

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 16.32 | n.a. | 77.309 | 56.202 | 95.58 | n.a. | BMB |
| 2 | 18.57 | n.a. | 2.947 | 2.598 | 4.42 | n.a. | BMB* |
| Total: | | | 80.256 | 58.800 | 100.00 | 0.000 | |





## 200 lik-lb-043-3-RAC-ASH-80-20-254-1.0

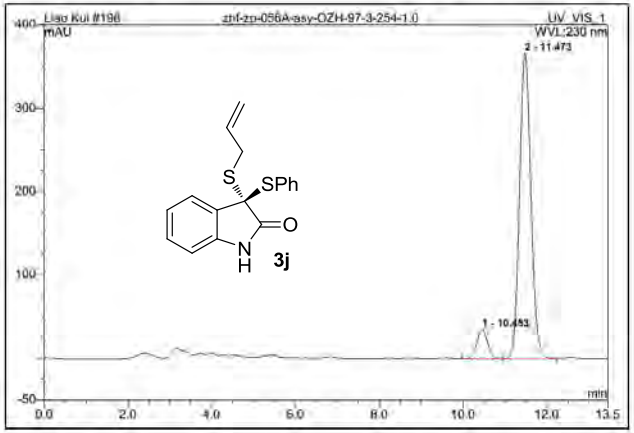
| | | | |
|---|---|---|---|
| *Sample Name:* | **lik-lb-043-3-RAC-ASH-80-20-254-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **298** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-30 10:12** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **24.80** | *Sample Amount:* | **1.0000** |




| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 16.36 | n.a. | 304.018 | 226.959 | 49.93 | n.a. | BM |
| 2 | 18.59 | n.a. | 224.443 | 227.629 | 50.07 | n.a. | MB |
| Total: | | | 528.462 | 454.588 | 100.00 | 0.000 | |

## 196 zhf-zp-056A-asy-OZH-97-3-254-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-056A-asy-OZH-97-3-254-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **294** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-29 21:42** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **13.45** | *Sample Amount:* | **1.0000** |



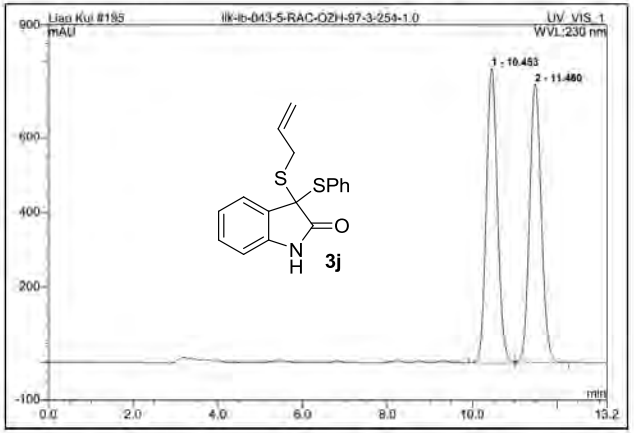

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 10.45 | n.a. | 35.652 | 10.501 | 8.34 | n.a. | BMB |
| 2 | 11.47 | n.a. | 366.514 | 115.408 | 91.66 | n.a. | BMB |
| Total: | | | 402.165 | 125.909 | 100.00 | 0.000 | |





## 195 lik-lb-043-5-RAC-OZH-97-3-254-1.0

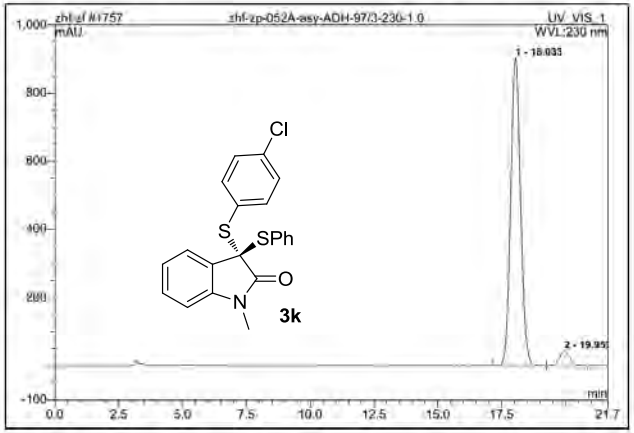
| | | | |
|---|---|---|---|
| *Sample Name:* | **lik-lb-043-5-RAC-OZH-97-3-254-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **293** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-29 21:26** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **13.17** | *Sample Amount:* | **1.0000** |




| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 10.45 | n.a. | 784.714 | 238.873 | 50.01 | n.a. | BM |
| 2 | 11.48 | n.a. | 743.434 | 238.819 | 49.99 | n.a. | MB |
| Total: | | | 1528.148 | 477.692 | 100.00 | 0.000 | |

## 1757 zhf-zp-052A-asy-ADH-97/3-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-052A-asy-ADH-97/3-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **865** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-15 14:03** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **21.65** | *Sample Amount:* | **1.0000** |



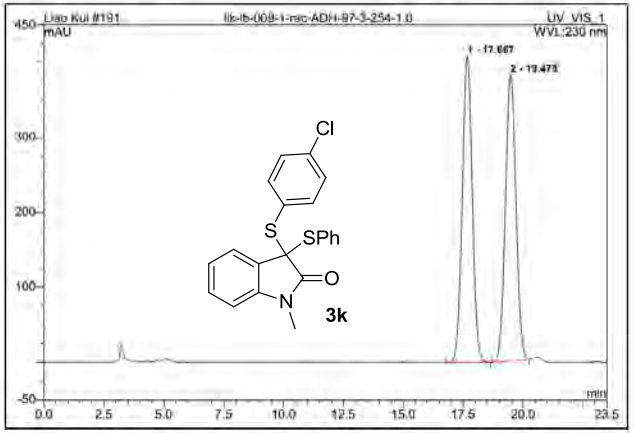

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 18.03 | n.a. | 902.685 | 405.599 | 95.06 | n.a. | BM |
| 2 | 19.95 | n.a. | 43.903 | 21.056 | 4.94 | n.a. | MB |
| Total: | | | 946.588 | 426.654 | 100.00 | 0.000 | |





## 191 lik-lb-009-1-rac-ADH-97-3-254-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **lik-lb-009-1-rac-ADH-97-3-254-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **289** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-29 14:24** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **23.49** | *Sample Amount:* | **1.0000** |



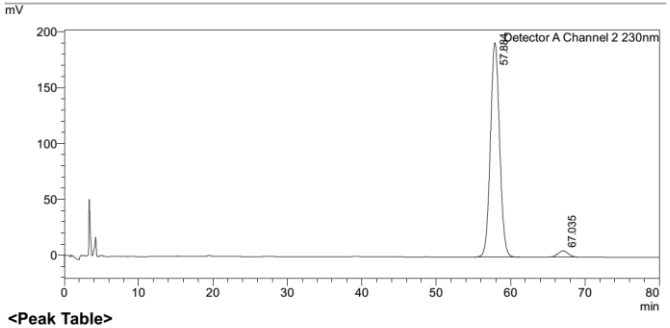

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 17.67 | n.a. | 408.591 | 197.741 | 50.40 | n.a. | BMB |
| 2 | 19.47 | n.a. | 381.953 | 194.606 | 49.60 | n.a. | BMB |
| Total: | | | 790.544 | 392.348 | 100.00 | 0.000 | |

# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : zhf-zp-052B-asy-ADH-97-3-254-1.0 | | |
| Sample ID | : | | |
| Data Filename | : zhf-zp-052B-asy-ADH-97-3-254-1.0.lcd | | |
| Method Filename | : method 1.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/5/9 18:05:55 | Acquired by | : System Administrator |
| Date Processed | : 2015/5/9 21:57:27 | Processed by | : System Administrator |

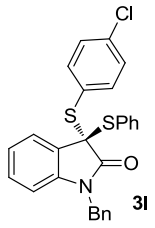
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 57.884 | 16512335 | 191854 | 96.940 |
| 2 | 67.035 | 521141 | 5525 | 3.060 |
| Total | | 17033476 | 197379 | |




**3l**



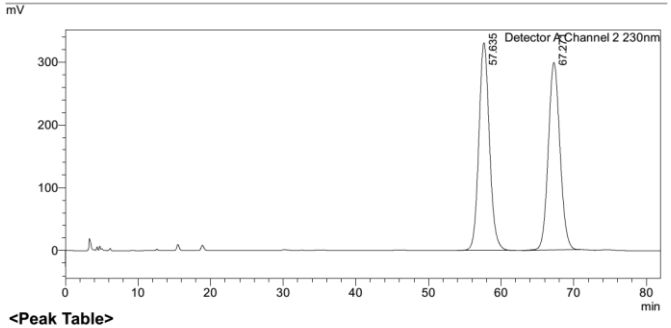


# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : zhf-zp-032B-rac-ADH-97-3-254-1.0 | | |
| Sample ID | : | | |
| Data Filename | : zhf-zp-032B-rac-ADH-97-3-254-1.0.lcd | | |
| Method Filename | : RUN-1.0.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/5/27 15:07:56 | Acquired by | : System Administrator |
| Date Processed | : 2015/6/9 10:57:01 | Processed by | : System Administrator |

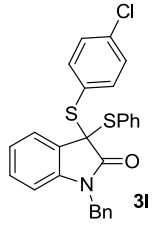
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

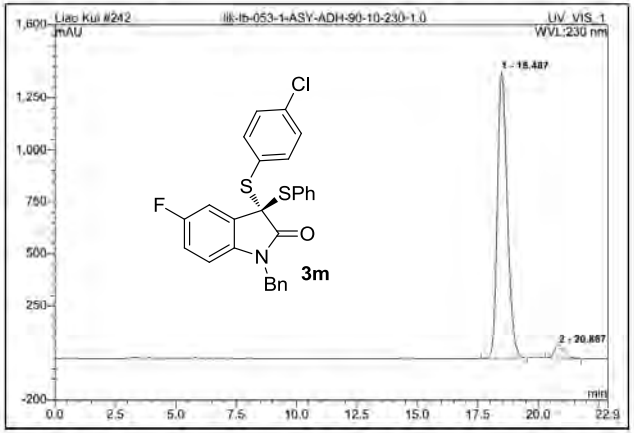
| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 57.635 | 33672023 | 330926 | 50.150 |
| 2 | 67.271 | 33470809 | 298530 | 49.850 |
| Total | | 67142832 | 629456 | |




**3l**

## 242 lik-lb-053-1-ASY-ADH-90-10-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **lik-lb-053-1-ASY-ADH-90-10-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **340** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-7-14 16:34** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **22.88** | *Sample Amount:* | **1.0000** |



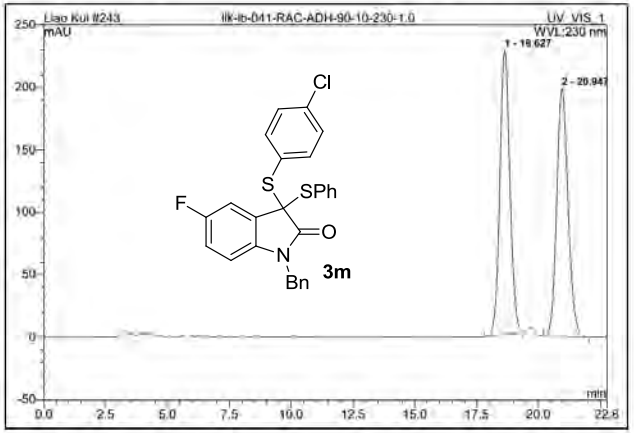

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 18.49 | n.a. | 1373.694 | 652.059 | 95.47 | n.a. | BMB |
| 2 | 20.87 | n.a. | 60.703 | 30.923 | 4.53 | n.a. | BMB |
| Total: | | | 1434.397 | 682.983 | 100.00 | 0.000 | |





## 243 lik-lb-041-RAC-ADH-90-10-230-1.0

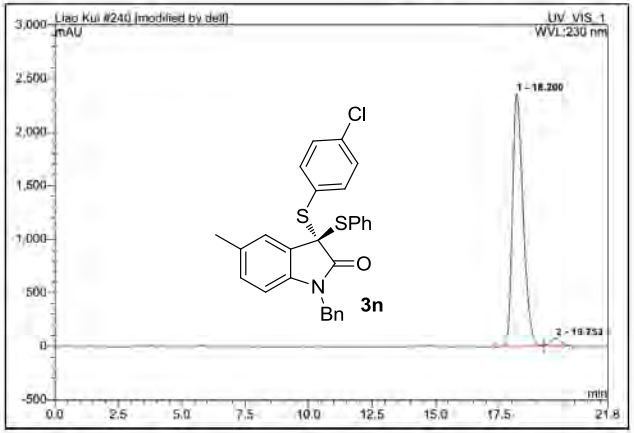
| | | | |
|---|---|---|---|
| *Sample Name:* | **lik-lb-041-RAC-ADH-90-10-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **341** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-7-14 16:58** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **22.77** | *Sample Amount:* | **1.0000** |




| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 18.63 | n.a. | 227.829 | 106.990 | 50.36 | n.a. | BMB |
| 2 | 20.95 | n.a. | 198.638 | 105.442 | 49.64 | n.a. | BMB |
| Total: | | | 426.468 | 212.432 | 100.00 | 0.000 | |

## 240 lik-lb-053---2---ASY-ADH-90-10-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **lik-lb-053---2---ASY-ADH-90-10-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **338** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-7-14 15:47** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **21.79** | *Sample Amount:* | **1.0000** |



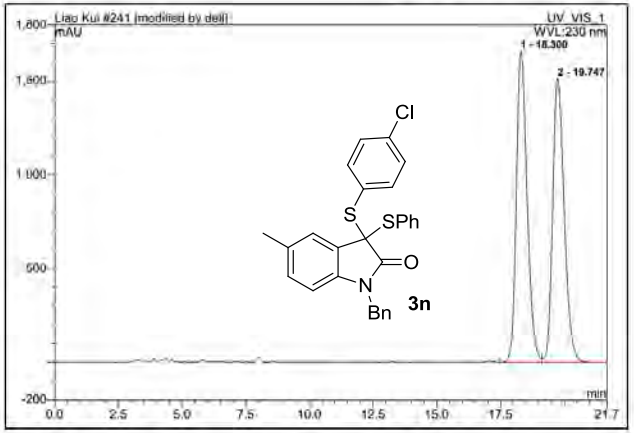

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 18.20 | n.a. | 2358.988 | 1149.672 | 97.13 | n.a. | BMB* |
| 2 | 19.75 | n.a. | 71.506 | 33.951 | 2.87 | n.a. | BMB* |
| Total: | | | 2430.494 | 1183.624 | 100.00 | 0.000 | |





## 241 lik-lb-036-RAC-ADH-90-10-230-1.0

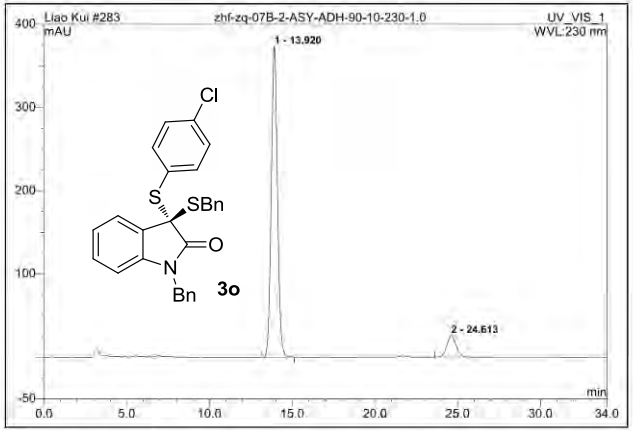
| | | | |
|---|---|---|---|
| *Sample Name:* | **lik-lb-036-RAC-ADH-90-10-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **339** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-7-14 16:11** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **21.68** | *Sample Amount:* | **1.0000** |




| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 18.30 | n.a. | 1660.024 | 812.019 | 50.52 | n.a. | BM |
| 2 | 19.75 | n.a. | 1514.865 | 795.303 | 49.48 | n.a. | MB |
| Total: | | | 3174.889 | 1607.322 | 100.00 | 0.000 | |

## 283 zhf-zq-07B-2-ASY-ADH-90-10-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zq-07B-2-ASY-ADH-90-10-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **381** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-7-22 17:33** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **34.02** | *Sample Amount:* | **1.0000** |



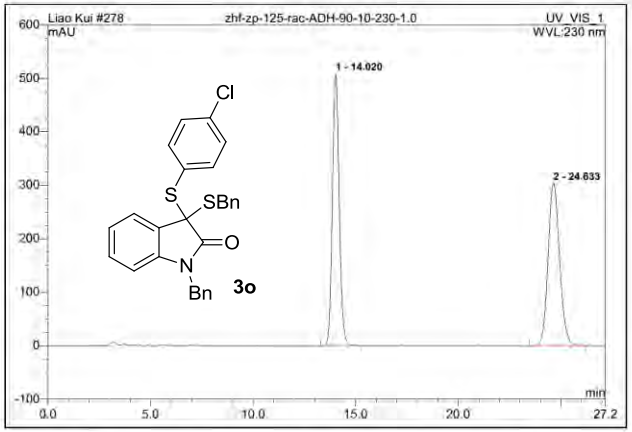

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 13.92 | n.a. | 373.513 | 162.485 | 90.57 | n.a. | BMB |
| 2 | 24.61 | n.a. | 25.809 | 16.909 | 9.43 | n.a. | BMB |
| **Total:** | | | 399.322 | 179.394 | 100.00 | 0.000 | |





## 278 zhf-zp-125-rac-ADH-90-10-230-1.0

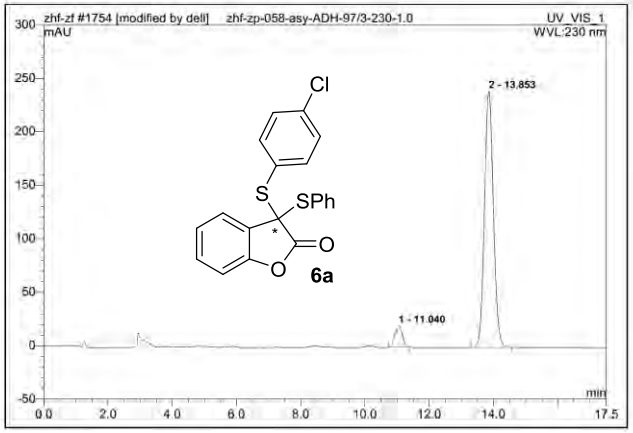
| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-125-rac-ADH-90-10-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **376** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-7-22 15:42** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **27.18** | *Sample Amount:* | **1.0000** |




| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 14.02 | n.a. | 509.553 | 196.716 | 49.95 | n.a. | BMB |
| 2 | 24.63 | n.a. | 304.527 | 197.082 | 50.05 | n.a. | BMB |
| **Total:** | | | 814.080 | 393.798 | 100.00 | 0.000 | |

## 1754 zhf-zp-058-asy-ADH-97/3-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-058-asy-ADH-97/3-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **862** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-15 10:40** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **17.52** | *Sample Amount:* | **1.0000** |



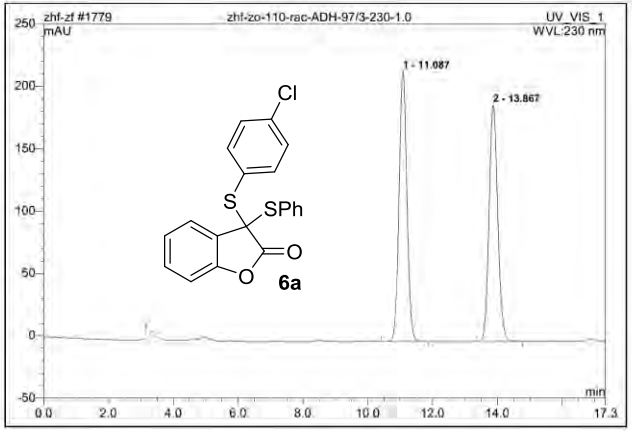

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 11.04 | n.a. | 19.938 | 5.360 | 6.52 | n.a. | BMB* |
| 2 | 13.85 | n.a. | 239.892 | 76.808 | 93.48 | n.a. | BMB* |
| **Total:** | | | 259.830 | 82.168 | 100.00 | 0.000 | |





## 1779 zhf-zo-110-rac-ADH-97/3-230-1.0

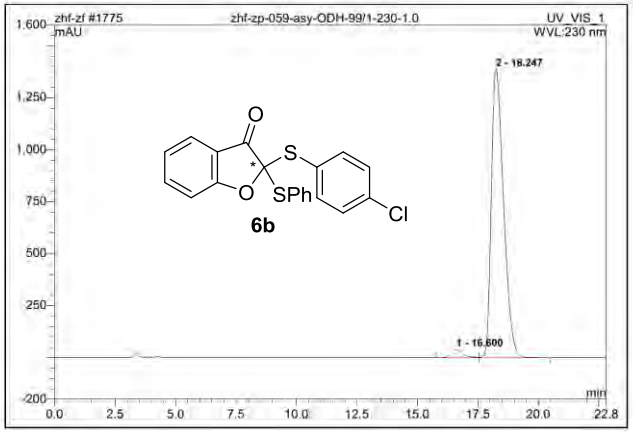
| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zo-110-rac-ADH-97/3-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **887** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-28 9:43** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **17.34** | *Sample Amount:* | **1.0000** |




| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 11.09 | n.a. | 216.655 | 60.716 | 50.78 | n.a. | BMB |
| 2 | 13.87 | n.a. | 189.643 | 58.847 | 49.22 | n.a. | BMB |
| **Total:** | | | 406.298 | 119.563 | 100.00 | 0.000 | |

## 1775 zhf-zp-059-asy-ODH-99/1-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-059-asy-ODH-99/1-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **883** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-27 17:22** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **22.82** | *Sample Amount:* | **1.0000** |



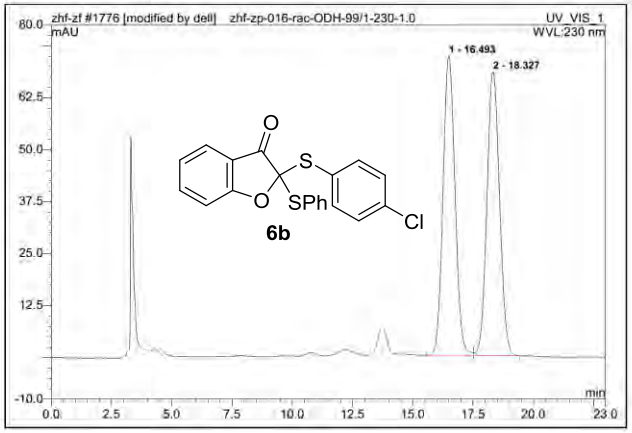

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 16.60 | n.a. | 40.155 | 22.489 | 2.69 | n.a. | BM |
| 2 | 18.25 | n.a. | 1388.672 | 813.396 | 97.31 | n.a. | MB |
| Total: | | | 1428.827 | 835.885 | 100.00 | 0.000 | |





## 1776 zhf-zp-016-rac-ODH-99/1-230-1.0

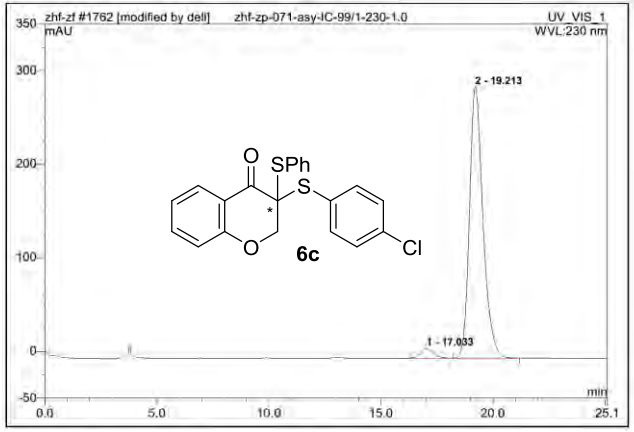
| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-016-rac-ODH-99/1-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **884** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-27 17:45** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **23.00** | *Sample Amount:* | **1.0000** |




| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 16.49 | n.a. | 72.057 | 41.507 | 50.09 | n.a. | BM |
| 2 | 18.33 | n.a. | 68.315 | 41.361 | 49.91 | n.a. | MB |
| Total: | | | 140.372 | 82.868 | 100.00 | 0.000 | |

## 1762 zhf-zp-071-asy-IC-99/1-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-071-asy-IC-99/1-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **870** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-15 17:15** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **25.11** | *Sample Amount:* | **1.0000** |



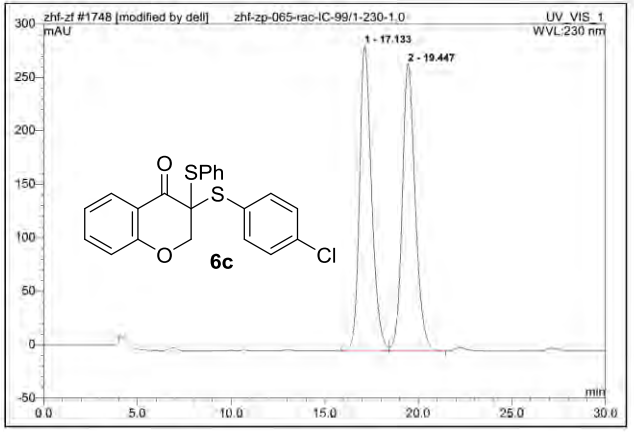

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 17.03 | n.a. | 10.315 | 6.649 | 3.19 | n.a. | BMB* |
| 2 | 19.21 | n.a. | 289.840 | 201.927 | 96.81 | n.a. | BMB* |
| Total: | | | 300.155 | 208.577 | 100.00 | 0.000 | |





## 1748 zhf-zp-065-rac-IC-99/1-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-065-rac-IC-99/1-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **856** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-12 18:18** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **30.00** | *Sample Amount:* | **1.0000** |



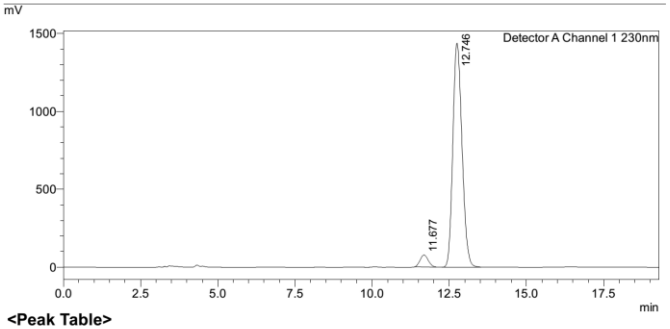

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 17.13 | n.a. | 285.620 | 213.798 | 49.89 | n.a. | BM |
| 2 | 19.45 | n.a. | 268.459 | 214.769 | 50.11 | n.a. | MB |
| Total: | | | 554.080 | 428.567 | 100.00 | 0.000 | |

# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : zhf-zq-021 | | |
| Sample ID | : | | |
| Data Filename | : zhf-zq-021-1-asy-ODH-99-1-230-1.0.lcd | | |
| Method Filename | : 2.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/7/24 17:37:24 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/25 10:16:50 | Processed by | : System Administrator |

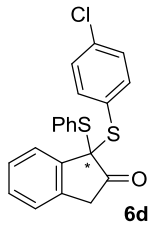
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 1 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 11.677 | 1402630 | 76587 | 4.503 |
| 2 | 12.746 | 29747260 | 1437389 | 95.497 |
| Total | | 31149890 | 1513976 | |




**6d**



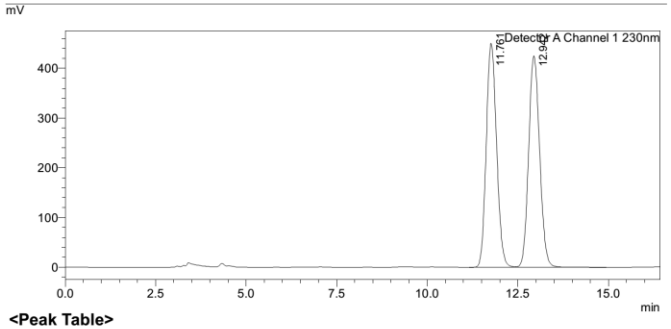


# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : zhf-zq-021 | | |
| Sample ID | : | | |
| Data Filename | : zhf-zq-021-rac-ODH-99-1-230-1.0.lcd | | |
| Method Filename | : 2.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/7/24 17:20:26 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/24 17:38:11 | Processed by | : System Administrator |

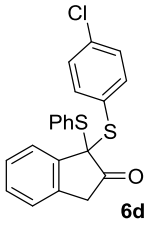
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 1 230nm

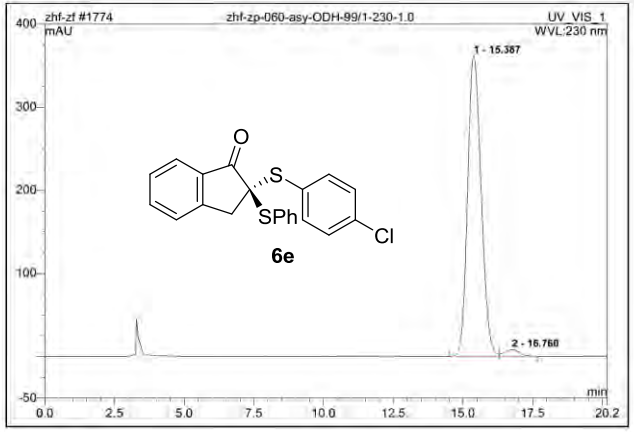
| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 11.761 | 8952886 | 450609 | 49.822 |
| 2 | 12.942 | 9016704 | 425387 | 50.178 |
| Total | | 17969590 | 875996 | |




**6d**

## 1774 zhf-zp-060-asy-ODH-99/1-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-060-asy-ODH-99/1-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **882** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-27 17:00** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **20.19** | *Sample Amount:* | **1.0000** |



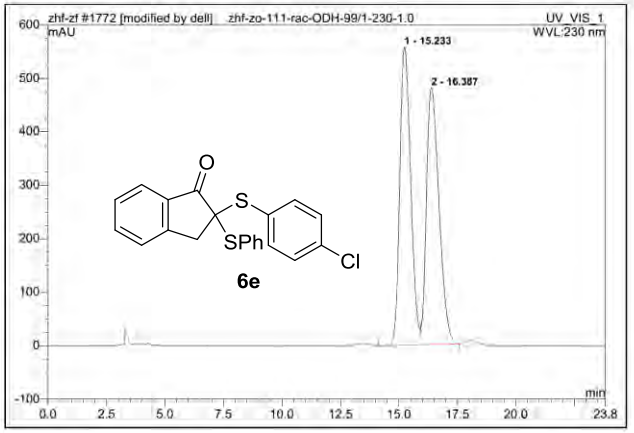

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 15.39 | n.a. | 361.704 | 203.477 | 97.56 | n.a. | BM |
| 2 | 16.76 | n.a. | 8.047 | 5.091 | 2.44 | n.a. | MB |
| Total: | | | 369.750 | 208.568 | 100.00 | 0.000 | |





## 1772 zhf-zo-111-rac-ODH-99/1-230-1.0

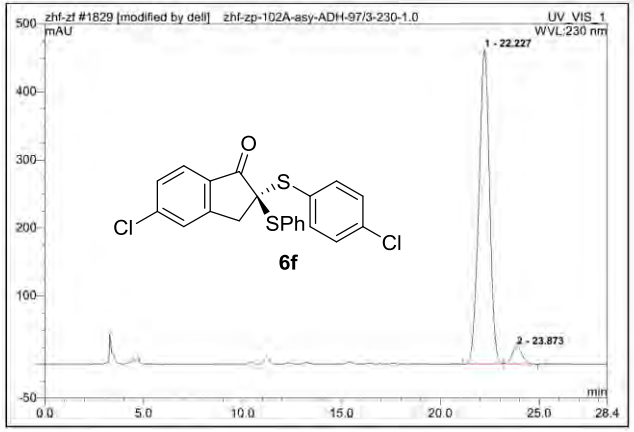
| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zo-111-rac-ODH-99/1-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **880** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-27 16:01** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **23.83** | *Sample Amount:* | **1.0000** |




| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 15.23 | n.a. | 557.506 | 299.879 | 50.05 | n.a. | BM * |
| 2 | 16.39 | n.a. | 480.002 | 299.241 | 49.95 | n.a. | MB* |
| Total: | | | 1037.508 | 599.120 | 100.00 | 0.000 | |

## 1829 zhf-zp-102A-asy-ADH-97/3-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-102A-asy-ADH-97/3-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **938** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-6-23 19:01** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **28.45** | *Sample Amount:* | **1.0000** |



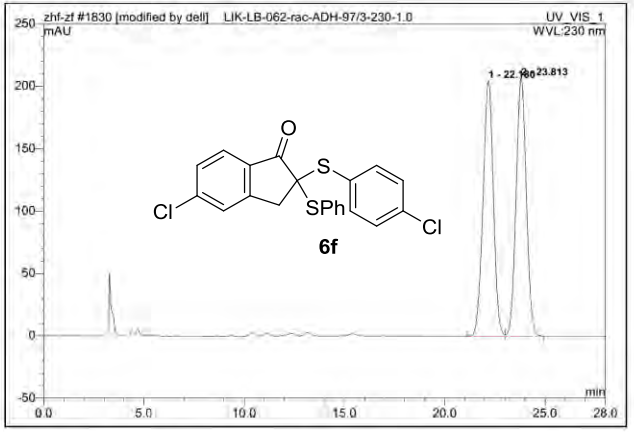

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 22.23 | n.a. | 462.502 | 290.101 | 94.94 | n.a. | BM |
| 2 | 23.87 | n.a. | 25.105 | 15.458 | 5.06 | n.a. | MB |
| **Total:** | | | 487.607 | 305.559 | 100.00 | 0.000 | |





## 1830 LIK-LB-062-rac-ADH-97/3-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **LIK-LB-062-rac-ADH-97/3-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **939** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-6-23 19:32** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **28.03** | *Sample Amount:* | **1.0000** |



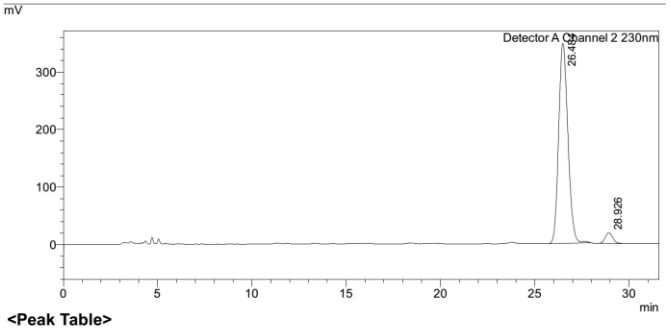

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 22.18 | n.a. | 204.803 | 122.356 | 50.02 | n.a. | BM |
| 2 | 23.81 | n.a. | 206.512 | 122.279 | 49.98 | n.a. | MB |
| **Total:** | | | 411.316 | 244.635 | 100.00 | 0.000 | |

# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : zhf-zp-102B-ASY-ADH-97-3-230-1.0 | | |
| Sample ID | : | | |
| Data Filename | : zhf-zp-102B-ASY-ADH-97-3-230-1.0.lcd | | |
| Method Filename | : chl-0128.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/7/27 12:51:30 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/27 16:26:49 | Processed by | : System Administrator |

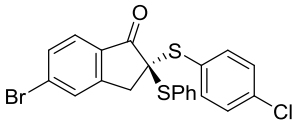
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 26.484 | 11846569 | 347614 | 95.938 |
| 2 | 28.926 | 501642 | 18234 | 4.062 |
| Total | | 12348211 | 365848 | |




**6g**



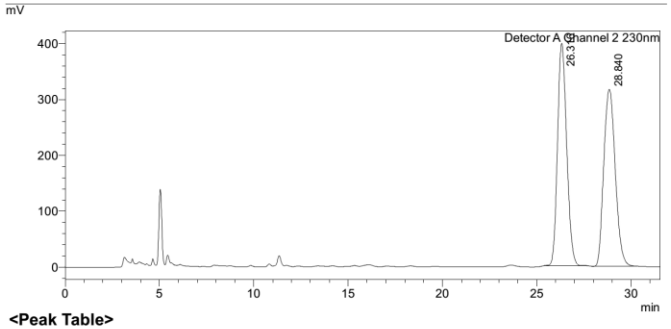


# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : LIK-LB-063-RAC-ADH-97-3-230-1.0 | | |
| Sample ID | : | | |
| Data Filename | : LIK-LB-063-RAC-ADH-97-3-230-1.0.lcd | | |
| Method Filename | : chl-0128.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/7/27 13:28:16 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/27 16:27:54 | Processed by | : System Administrator |

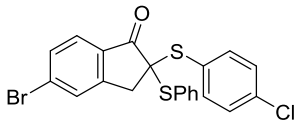
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 26.316 | 13481467 | 398299 | 50.124 |
| 2 | 28.840 | 13415018 | 316822 | 49.876 |
| Total | | 26896485 | 715121 | |



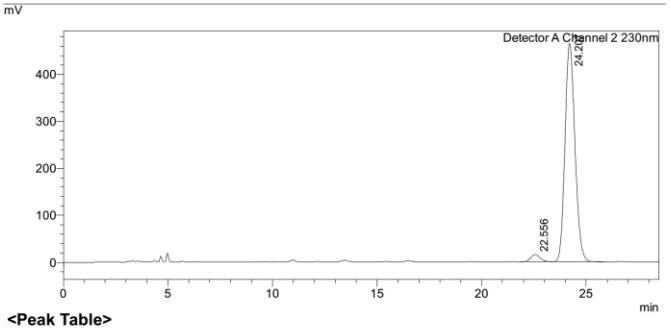

**6g**

# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : zhf-zp-102C-ASY-ADH-97-3-230-1.0 | | |
| Sample ID | : | | |
| Data Filename | : zhf-zp-102C-ASY-ADH-97-3-230-1.0.lcd | | |
| Method Filename | : RUN-1.0.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/7/18 9:32:13 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/18 22:35:09 | Processed by | : System Administrator |

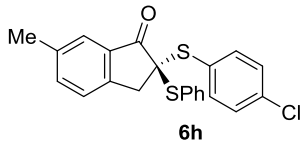
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 22.556 | 487785 | 15348 | 3.069 |
| 2 | 24.207 | 15407457 | 464695 | 96.931 |
| Total | | 15895242 | 480043 | |




**6h**



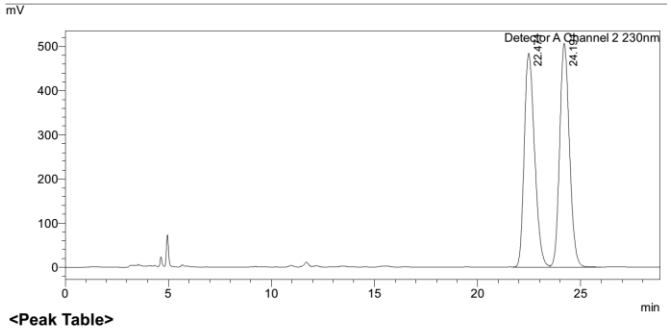


# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : LIK-LB-091-1-RACADH-97-3-230-1.0 | | |
| Sample ID | : | | |
| Data Filename | : LIK-LB-091-1-RACADH-97-3-230-1.0.lcd | | |
| Method Filename | : RUN-1.0.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/7/18 10:02:03 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/18 22:36:02 | Processed by | : System Administrator |

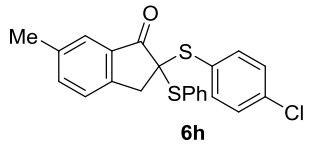
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 22.471 | 16852937 | 484134 | 50.178 |
| 2 | 24.191 | 16733333 | 506547 | 49.822 |
| Total | | 33586269 | 990681 | |



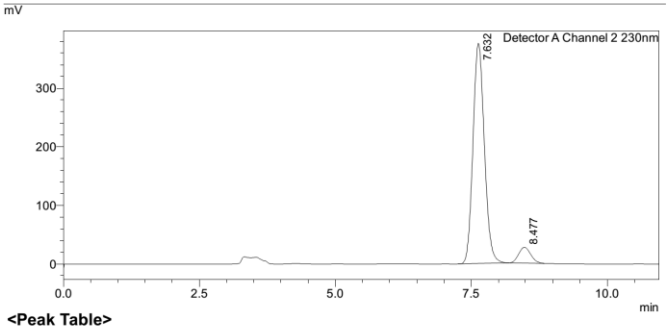

**6h**

# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : ZHF-ZP-083 | | |
| Sample ID | : | | |
| Data Filename | : zhf-zp-083-asy-ODH-95-5-230-1.0.lcd | | |
| Method Filename | : method 1.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/5/29 11:36:35 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/22 16:15:23 | Processed by | : System Administrator |

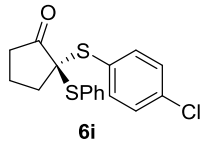
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 7.632 | 5478511 | 375916 | 92.941 |
| 2 | 8.477 | 416072 | 27078 | 7.059 |
| Total | | 5894583 | 402993 | |




**6i**



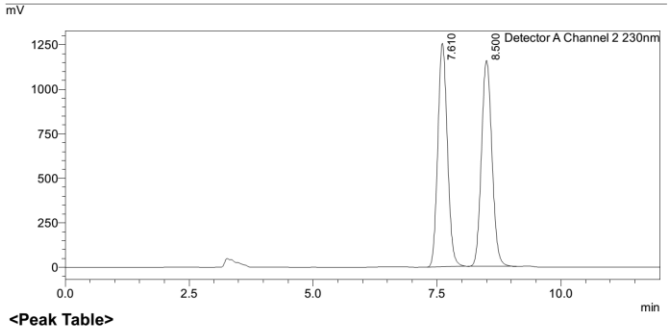


# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : zhf-zp-076A | | |
| Sample ID | : | | |
| Data Filename | : zhf-zp-076A-rac-ODH-95-5-230-1.0.lcd | | |
| Method Filename | : chl-0128.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/5/22 10:52:41 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/14 9:43:38 | Processed by | : System Administrator |

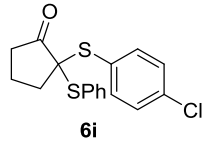
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

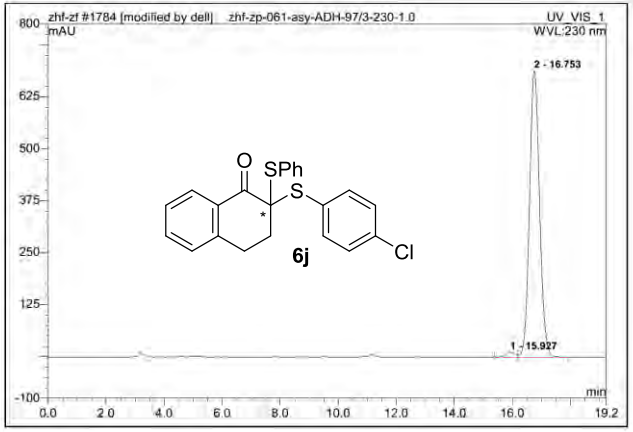
| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 7.610 | 16925253 | 1256144 | 49.726 |
| 2 | 8.500 | 17111773 | 1158380 | 50.274 |
| Total | | 34037027 | 2414523 | |




**6i**

## 1784 zhf-zp-061-asy-ADH-97/3-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-061-asy-ADH-97/3-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **892** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-29 9:20** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **19.25** | *Sample Amount:* | **1.0000** |



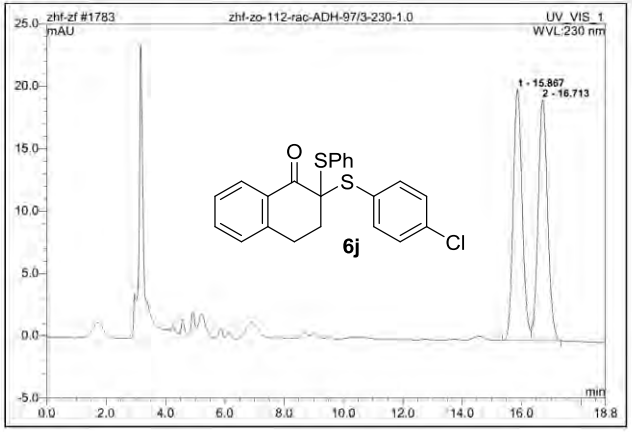

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 15.93 | n.a. | 11.813 | 4.299 | 1.53 | n.a. | BM |
| 2 | 16.75 | n.a. | 688.598 | 276.210 | 98.47 | n.a. | MB |
| Total: | | | 700.411 | 280.509 | 100.00 | 0.000 | |





## 1783 zhf-zo-112-rac-ADH-97/3-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zo-112-rac-ADH-97/3-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **891** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-29 8:55** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **18.84** | *Sample Amount:* | **1.0000** |



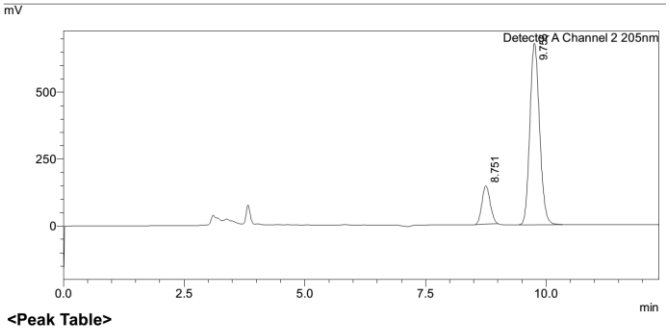

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 15.87 | n.a. | 20.134 | 7.088 | 49.77 | n.a. | BM |
| 2 | 16.71 | n.a. | 19.300 | 7.153 | 50.23 | n.a. | MB |
| Total: | | | 39.434 | 14.241 | 100.00 | 0.000 | |

# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : zhf-zq-020 | | |
| Sample ID | : | | |
| Data Filename | : zhf-zq-020-asy-ADH-90-10-230-1.0.lcd | | |
| Method Filename | : 2.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/7/24 12:43:52 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/24 13:13:11 | Processed by | : System Administrator |

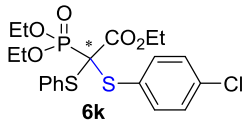
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 205nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 8.751 | 1685426 | 143049 | 15.045 |
| 2 | 9.755 | 9517482 | 678677 | 84.955 |
| Total | | 11202907 | 821726 | |




**6k**



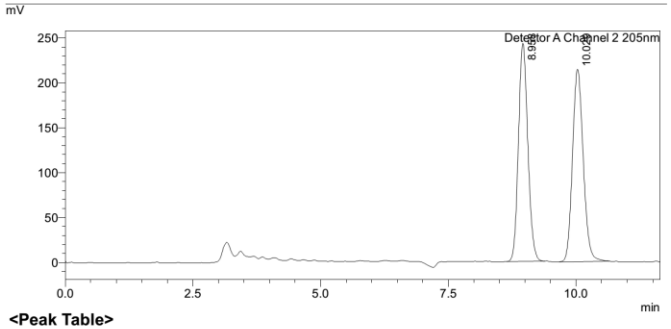


# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : LIK-LB-091B | | |
| Sample ID | : | | |
| Data Filename | : LIK-LB-091B-1-rac-ADH-90-10-230-1.0.lcd | | |
| Method Filename | : 2.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/7/24 15:01:08 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/24 15:15:04 | Processed by | : System Administrator |

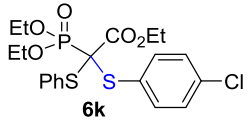
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 205nm

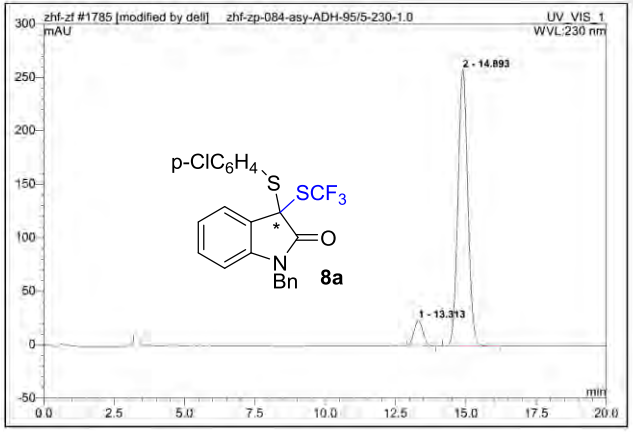
| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 8.958 | 3113564 | 243000 | 49.831 |
| 2 | 10.029 | 3134709 | 214064 | 50.169 |
| Total | | 6248273 | 457064 | |




**6k**

## 1785 zhf-zp-084-asy-ADH-95/5-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-084-asy-ADH-95/5-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **893** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-29 12:21** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **20.00** | *Sample Amount:* | **1.0000** |



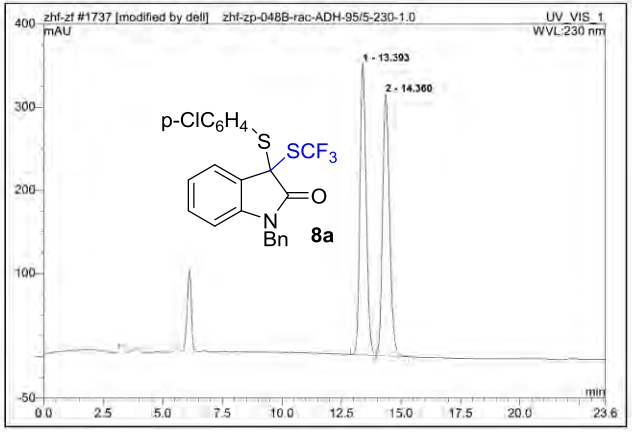

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 13.31 | n.a. | 23.520 | 8.697 | 7.64 | n.a. | BMB* |
| 2 | 14.89 | n.a. | 257.926 | 105.102 | 92.36 | n.a. | BMB* |
| **Total:** | | | 281.446 | 113.799 | 100.00 | 0.000 | |





## 1737 zhf-zp-048B-rac-ADH-95/5-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-048B-rac-ADH-95/5-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **845** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-5-11 8:33** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **23.59** | *Sample Amount:* | **1.0000** |



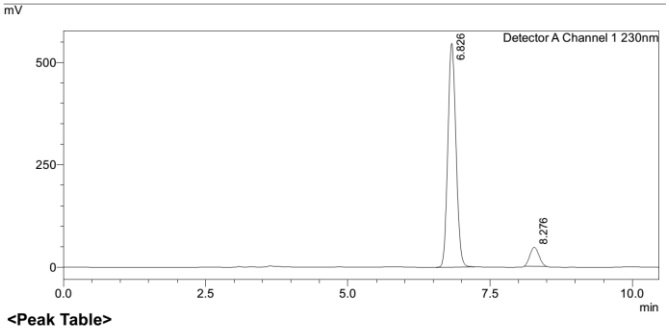

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 13.39 | n.a. | 349.898 | 107.124 | 49.88 | n.a. | BM |
| 2 | 14.36 | n.a. | 314.163 | 107.618 | 50.12 | n.a. | MB |
| **Total:** | | | 664.061 | 214.742 | 100.00 | 0.000 | |

# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : ZHF-ZQ-019 | | |
| Sample ID | : | | |
| Data Filename | : zhf-zq-019-1-asy-ODH-99-1-230-1.0.lcd | | |
| Method Filename | : 2.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/7/24 16:27:35 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/25 10:25:50 | Processed by | : System Administrator |

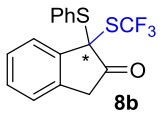
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 1 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 6.826 | 5431898 | 546877 | 91.405 |
| 2 | 8.276 | 510778 | 46218 | 8.595 |
| Total | | 5942676 | 593095 | |




**8b**



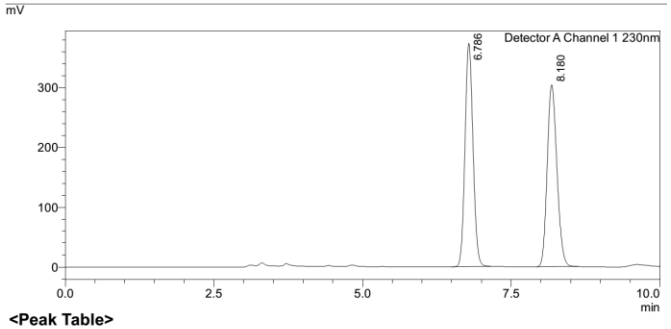


# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : LIK-LB-063 | | |
| Sample ID | : | | |
| Data Filename | : LIK-LB-063-RAC-ODH-99-1-230-1.0.lcd | | |
| Method Filename | : 2.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/7/24 16:40:44 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/25 10:22:02 | Processed by | : System Administrator |

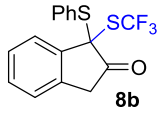
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 1 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 6.786 | 3501971 | 373485 | 50.274 |
| 2 | 8.180 | 3463745 | 304108 | 49.726 |
| Total | | 6965716 | 677593 | |



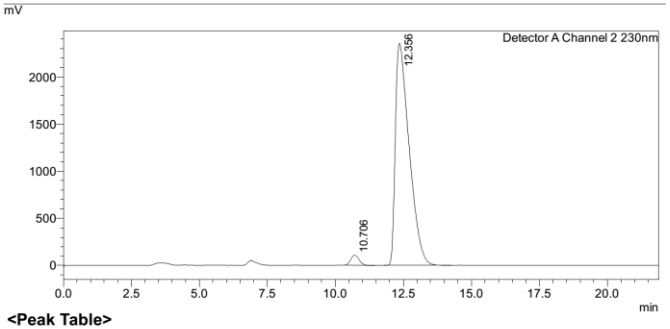

**8b**

# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : ZHF-ZP-110-ASY-OJH-80-20-230-1.0 | | |
| Sample ID | : | | |
| Data Filename | : zhf-zp-110-asy-OJH-80-20-230-1.1.lcd | | |
| Method Filename | : chl-0128.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/7/11 15:41:36 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/11 16:04:22 | Processed by | : System Administrator |

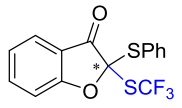
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 10.706 | 2349638 | 107463 | 2.741 |
| 2 | 12.356 | 83358980 | 2357424 | 97.259 |
| Total | | 85708618 | 2464887 | |




**8c**



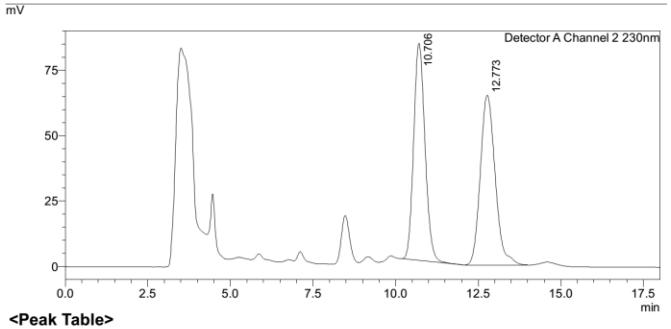


# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : LIK-LB-088-RAC-OJH-80-20-230-1.0 | | |
| Sample ID | : | | |
| Data Filename | : LIK-LB-088-RAC-OJH-80-20-230-1.1.lcd | | |
| Method Filename | : chl-0128.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/7/11 16:06:09 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/13 21:55:55 | Processed by | : System Administrator |

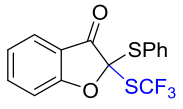
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

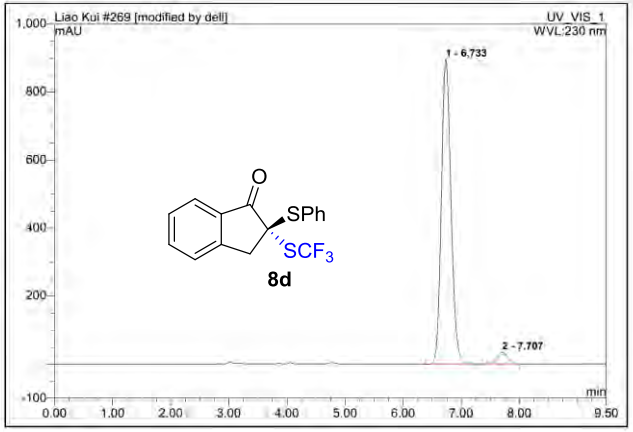
| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 10.706 | 1985675 | 83014 | 49.427 |
| 2 | 12.773 | 2031748 | 64888 | 50.573 |
| Total | | 4017423 | 147902 | |




**8c**

## 269 ZHF-ZP-85-ASY-ODH-99-1-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **ZHF-ZP-85-ASY-ODH-99-1-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **367** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-7-17 17:19** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **13.83** | *Sample Amount:* | **1.0000** |



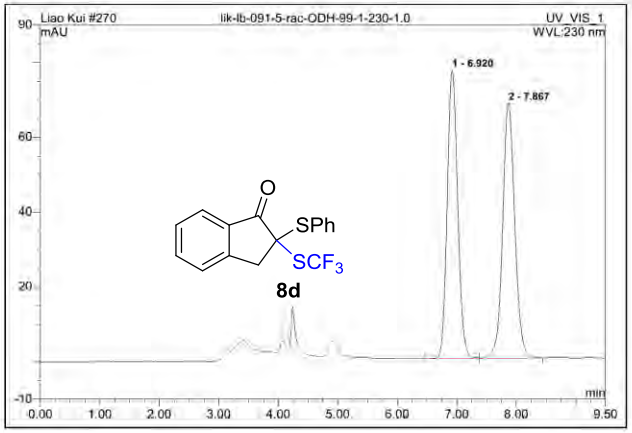

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 6.73 | n.a. | 895.086 | 172.086 | 96.00 | n.a. | BMB* |
| 2 | 7.71 | n.a. | 34.097 | 7.164 | 4.00 | n.a. | BMB* |
| **Total:** | | | 929.183 | 179.250 | 100.00 | 0.000 | |





## 270 lik-lb-091-5-rac-ODH-99-1-230-1.0

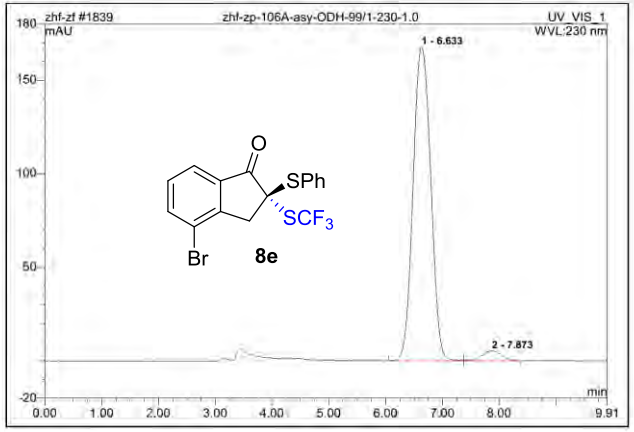
| | | | |
|---|---|---|---|
| *Sample Name:* | **lik-lb-091-5-rac-ODH-99-1-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **368** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-7-17 17:35** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **13.49** | *Sample Amount:* | **1.0000** |




| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 6.92 | n.a. | 77.188 | 15.705 | 49.31 | n.a. | BM |
| 2 | 7.87 | n.a. | 68.251 | 16.142 | 50.69 | n.a. | MB |
| **Total:** | | | 145.439 | 31.847 | 100.00 | 0.000 | |

## 1839 zhf-zp-106A-asy-ODH-99/1-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-106A-asy-ODH-99/1-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **948** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-6-24 10:37** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **9.91** | *Sample Amount:* | **1.0000** |



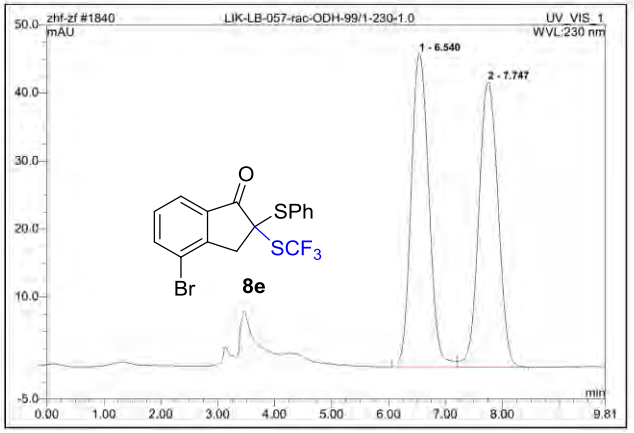

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 6.63 | n.a. | 167.556 | 60.368 | 96.67 | n.a. | BM |
| 2 | 7.87 | n.a. | 5.244 | 2.076 | 3.33 | n.a. | MB |
| **Total:** | | | 172.800 | 62.444 | 100.00 | 0.000 | |





## 1840 LIK-LB-057-rac-ODH-99/1-230-1.0

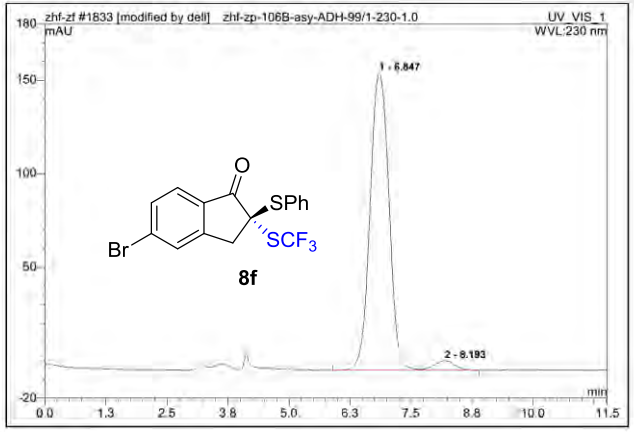
| | | | |
|---|---|---|---|
| *Sample Name:* | **LIK-LB-057-rac-ODH-99/1-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **949** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-6-24 10:48** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **9.81** | *Sample Amount:* | **1.0000** |




| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 6.54 | n.a. | 46.032 | 16.613 | 50.22 | n.a. | BM |
| 2 | 7.75 | n.a. | 41.888 | 16.468 | 49.78 | n.a. | MB |
| **Total:** | | | 87.920 | 33.081 | 100.00 | 0.000 | |

## 1833 zhf-zp-106B-asy-ADH-99/1-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-106B-asy-ADH-99/1-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **942** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-6-23 21:29** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **11.53** | *Sample Amount:* | **1.0000** |



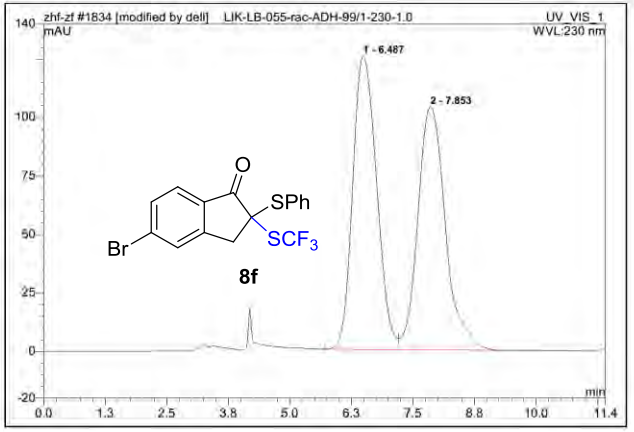

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 6.85 | n.a. | 158.828 | 71.233 | 96.56 | n.a. | BM |
| 2 | 8.19 | n.a. | 5.076 | 2.534 | 3.44 | n.a. | MB |
| Total: | | | 163.904 | 73.768 | 100.00 | 0.000 | |





## 1834 LIK-LB-055-rac-ADH-99/1-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **LIK-LB-055-rac-ADH-99/1-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **943** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-6-23 21:44** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **11.41** | *Sample Amount:* | **1.0000** |



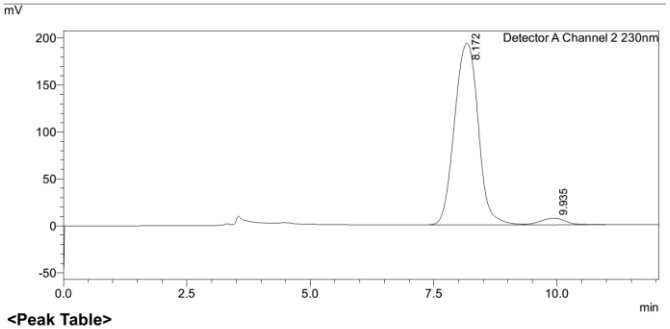

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 6.49 | n.a. | 125.457 | 70.400 | 50.96 | n.a. | BM |
| 2 | 7.85 | n.a. | 103.966 | 67.754 | 49.04 | n.a. | MB |
| Total: | | | 229.424 | 138.154 | 100.00 | 0.000 | |

# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : zhf-zp-106-C-ASY-ADH-99-1-230-1.0 | | |
| Sample ID | : | | |
| Data Filename | : zhf-zp-106-C-ASY-ADH-99-1-230-1.0.lcd | | |
| Method Filename | : RUN-1.0.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/6/24 9:44:47 | Acquired by | : System Administrator |
| Date Processed | : 2015/6/24 10:12:33 | Processed by | : System Administrator |

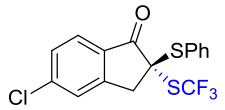
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 8.172 | 6456606 | 193635 | 96.377 |
| 2 | 9.935 | 242694 | 6810 | 3.623 |
| Total | | 6699300 | 200445 | |




**8g**



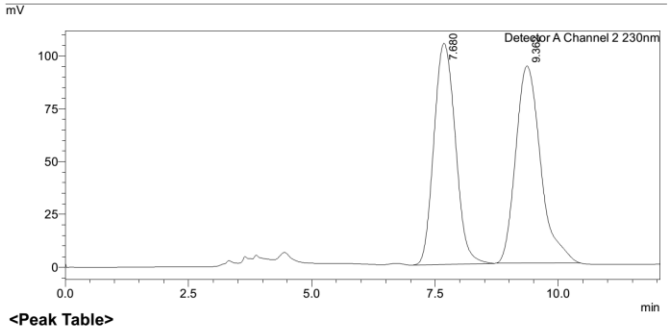


# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : LIK-LB-054-RAC-ADH-99-1-230-1.0 | | |
| Sample ID | : | | |
| Data Filename | : LIK-LB-054-RAC-ADH-99-1-230-1.0.lcd | | |
| Method Filename | : RUN-1.0.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/6/24 9:57:52 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/13 21:52:11 | Processed by | : System Administrator |

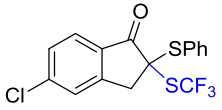
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

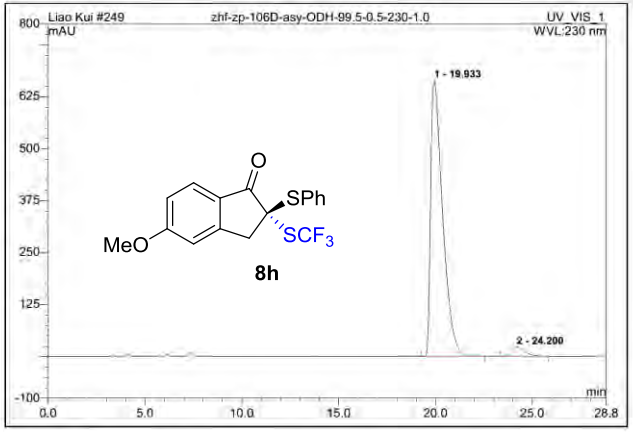
| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 7.680 | 3175856 | 104669 | 49.167 |
| 2 | 9.362 | 3283404 | 93267 | 50.833 |
| Total | | 6459260 | 197936 | |




**8g**

## 249 zhf-zp-106D-asy-ODH-99.5-0.5-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-106D-asy-ODH-99.5-0.5-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **347** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-7-15 9:07** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **28.83** | *Sample Amount:* | **1.0000** |



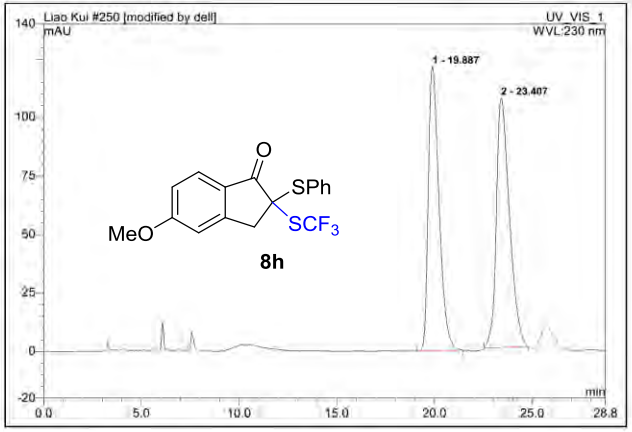

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 19.93 | n.a. | 664.302 | 475.939 | 96.48 | n.a. | BMB |
| 2 | 24.20 | n.a. | 22.210 | 17.350 | 3.52 | n.a. | BMB |
| **Total:** | | | 686.512 | 493.289 | 100.00 | 0.000 | |





## 250 lik-lb-084-2-rac-ODH-99.5-0.5-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **lik-lb-084-2-rac-ODH-99.5-0.5-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **348** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-7-15 9:38** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **28.75** | *Sample Amount:* | **1.0000** |



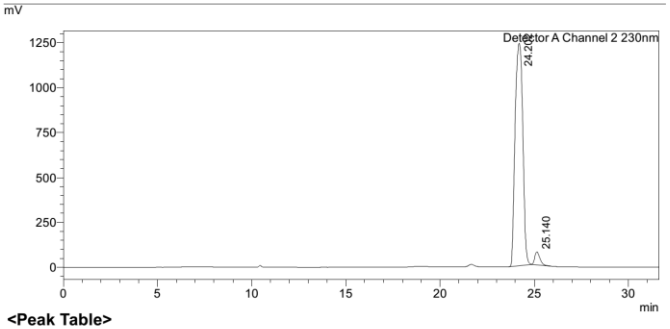

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 19.89 | n.a. | 121.386 | 77.338 | 48.29 | n.a. | BMB* |
| 2 | 23.41 | n.a. | 106.758 | 82.809 | 51.71 | n.a. | BMB* |
| **Total:** | | | 228.144 | 160.148 | 100.00 | 0.000 | |

# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : ZHF-ZP-129A--ADH-ADH-99.5-0.5-230-0.5 | | |
| Sample ID | : | | |
| Data Filename | : ZHF-ZP-129A-ADH-ADH-99.5-0.5-230-1.0.lcd | | |
| Method Filename | : RUN-1.0.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/7/21 23:05:22 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/22 15:28:06 | Processed by | : System Administrator |

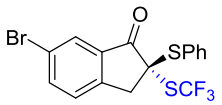
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 24.202 | 35156642 | 1238540 | 96.205 |
| 2 | 25.140 | 1386886 | 72244 | 3.795 |
| Total | | 36543528 | 1310784 | |




**8i**



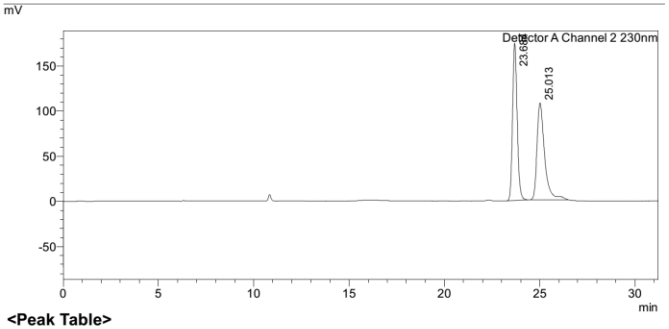


# Analysis Report

**<Sample Information>**

| | | | |
|---|---|---|---|
| Sample Name | : LIK-LB-091-4-RAC-ADH-ADH-99.5-0.5-230-0.5 | | |
| Sample ID | : | | |
| Data Filename | : LIK-LB-091-RAC-ADH-ADH-99.5-0.5-230-1.0.lcd | | |
| Method Filename | : RUN-1.0.lcm | | |
| Batch Filename | : | | |
| Vial # | : 1-1 | Sample Type | : Unknown |
| Injection Volume | : 10 uL | | |
| Date Acquired | : 2015/7/21 22:06:01 | Acquired by | : System Administrator |
| Date Processed | : 2015/7/22 15:31:07 | Processed by | : System Administrator |

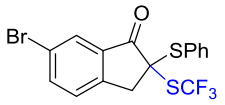
**<Chromatogram>**




**<Peak Table>**

Detector A Channel 2 230nm

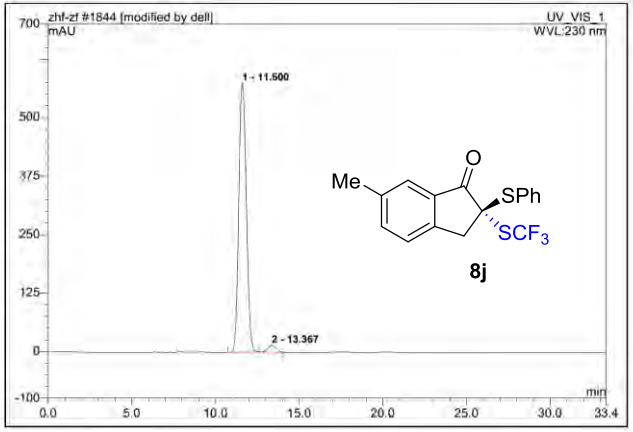
| Peak# | Ret. Time | Area | Height | Conc. |
|---|---|---|---|---|
| 1 | 23.684 | 2950081 | 174206 | 49.596 |
| 2 | 25.013 | 2998149 | 107449 | 50.404 |
| Total | | 5948230 | 281656 | |




**8i**

## 1844 zhf-zp-106E-asy-ODH-ODH-99/1-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-106E-asy-ODH-ODH-99/1-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **953** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-6-24 14:19** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **33.37** | *Sample Amount:* | **1.0000** |



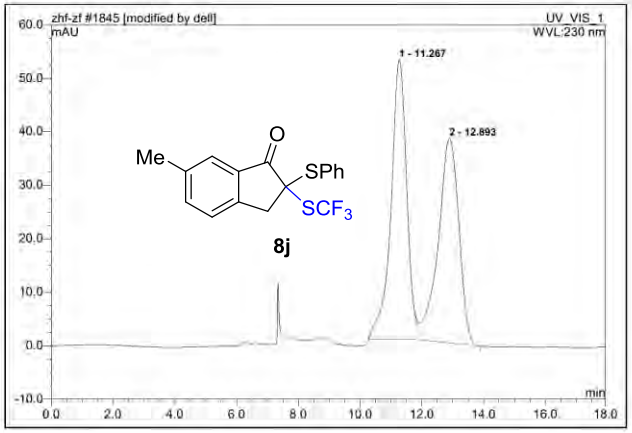

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 11.60 | n.a. | 575.010 | 299.423 | 97.16 | n.a. | BMb* |
| 2 | 13.37 | n.a. | 14.256 | 8.760 | 2.84 | n.a. | bMB* |
| Total: | | | 589.266 | 308.184 | 100.00 | 0.000 | |





## 1845 LIK-LB-059-rac-ODH-ODH-99/1-230-1.0

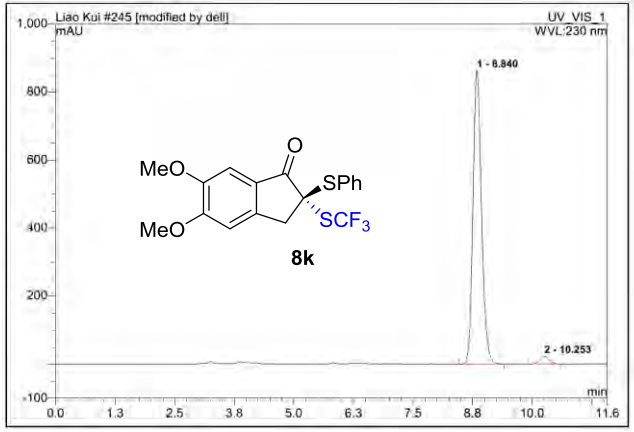
| | | | |
|---|---|---|---|
| *Sample Name:* | **LIK-LB-059-rac-ODH-ODH-99/1-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **954** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **unknown** | *Wavelength:* | **230** |
| *Control Program:* | **zhf** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **zhf** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-6-24 14:56** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **17.95** | *Sample Amount:* | **1.0000** |




| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 11.27 | n.a. | 52.302 | 30.625 | 50.59 | n.a. | BM * |
| 2 | 12.89 | n.a. | 38.208 | 29.916 | 49.41 | n.a. | MB* |
| Total: | | | 90.511 | 60.541 | 100.00 | 0.000 | |

## 245 zhf-zp-106F-asy-ADH-90-10-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **zhf-zp-106F-asy-ADH-90-10-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **343** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-7-14 19:59** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **11.58** | *Sample Amount:* | **1.0000** |



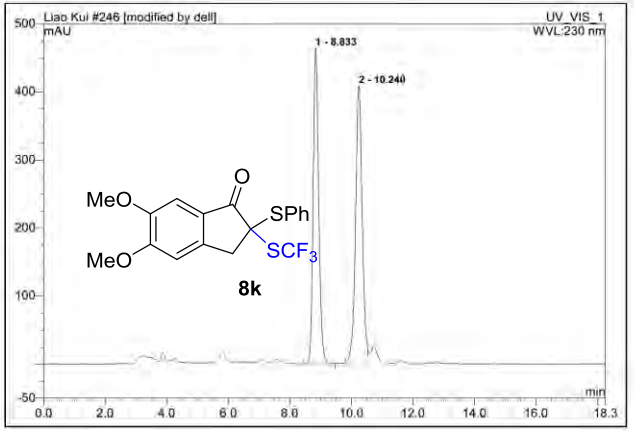

| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 8.84 | n.a. | 864.170 | 180.929 | 96.94 | n.a. | BMB* |
| 2 | 10.25 | n.a. | 24.142 | 5.706 | 3.06 | n.a. | BMB* |
| Total: | | | 888.313 | 186.635 | 100.00 | 0.000 | |





## 246 lik-lb-084-3-rac-ADH-90-10-230-1.0

| | | | |
|---|---|---|---|
| *Sample Name:* | **lik-lb-084-3-rac-ADH-90-10-230-1.0** | *Injection Volume:* | **20.0** |
| *Vial Number:* | **344** | *Channel:* | **UV_VIS_1** |
| *Sample Type:* | **standard** | *Wavelength:* | **230** |
| *Control Program:* | **Liao Kui** | *Bandwidth:* | **n.a.** |
| *Quantif. Method:* | **Liao Kui** | *Dilution Factor:* | **1.0000** |
| *Recording Time:* | **2015-7-14 20:13** | *Sample Weight:* | **1.0000** |
| *Run Time (min):* | **18.26** | *Sample Amount:* | **1.0000** |




| No. | Ret.Time min | Peak Name | Height mAU | Area mAU*min | Rel.Area % | Amount | Type |
|---|---|---|---|---|---|---|---|
| 1 | 8.83 | n.a. | 463.666 | 96.328 | 48.57 | n.a. | BMB |
| 2 | 10.24 | n.a. | 407.595 | 101.988 | 51.43 | n.a. | BMB* |
| Total: | | | 871.261 | 198.316 | 100.00 | 0.000 | |