Supporting Information

Iodine-Promoted Synthesis of 4-Aryl-2-(arylsulfonyl)quinolones by Desulfurative C–S Cross-Coupling Reaction of Quinoline-2-thiones with Sodium Sulfinates

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General

Unless otherwise noted, all commercially available compounds were used as provided without further purification. \textsuperscript{1}H NMR and \textsuperscript{13}C NMR data analyses were performed with a Varian Mercury plus-400 and Agilent 600 MHz DD2 instruments CDCl\textsubscript{3} solvent and tetramethylsilane (TMS) as the internal standard were employed. Chemical shifts were reported in units (ppm) by assigning TMS resonance in the \textsuperscript{1}H NMR spectrum as 0.00 ppm. The data of \textsuperscript{1}H NMR was reported as follows: chemical shift, multiplicity (s = singlet, d = doublet, t = triplet, m = multiplet and br = broad), coupling constant (J values) in Hz and integration. Chemical shift for \textsuperscript{13}C NMR spectra were recorded in ppm from TMS using the central peak of CDCl\textsubscript{3} (77.0 ppm) as the internal standard. \textsuperscript{19}F NMR spectra were recorded on a Varian Mercury 400 plus instrument. Flash chromatography was performed using 200-300 mesh silica gel with the indicated solvent system according to standard techniques. Analytical thin-layer chromatography (TLC) was performed on pre-coated, glass-backed silica gel plates. Melting points were measured with an XT-4 apparatus. High-resolution mass spectra (HRMS) (ESI) were obtained with a Q-exactive mass spectrometer. Column chromatography was generally performed on silica gel (200-300 mesh) and TLC analyses were conducted on silica gel GF254 plates. All reagents were directly used from purchased without any further purification unless otherwise specified.

Synthetic procedures

1.1 Synthesis of 2-(1-aryvinyl)aniline.
2-(1-aryvinyl)aniline was prepared according to the reported procedures.\textsuperscript{1} 1.0 g of montmorillonites K10 was added to a solution of phenylacetylene (1.0 g, 10.0 mmol) and \textit{para}-tolylidine (1.1 g, 10.0 mmol) in the xylene (10.0 mL). The mixture was heated at the 140 °C under stirring for 5 hours. After cooling to room temperature, filtration, washing with diethyl ether and distillation of the solvents. The volatiles were removed in vacuum. The residue was purified by column chromatography on silica gel (ethyl acetate/ petroleum ether 1:5) to give the corresponding products.

1.2 \textit{Synthesis of 4-phenylquinoline-2(1H)-thione 1a.}

\[
\text{NH}_2 + \text{C}_6\text{H}_5\text{C}_2\text{H}_4\text{C}_2\text{H}_5 \xrightarrow{\text{KFS10, xylene, 140 °C, 5 h}} \text{NH}_2 \text{C}_6\text{H}_4\text{C}_6\text{H}_5
\]

Under an atmosphere of air, 2-(1-phenylvinyl) aniline (0.5 mmol, 0.0095 g), CS\textsubscript{2} (2.4 eq. 0.6 mmol, 0.0046 g), DBU (5 mol%, 0.00018 g) were added to a tube. DMF (3.0 mL) was added by dropper and the mixture was stirred for 8 h at 140 °C and the reaction was monitored by TLC analysis. Then, 2.0 mL ammonium chloride were added to the mixture to quench the reaction and extracted with ethyl acetate (3×25 mL). The combined organic layers were washed with aqueous NaHCO\textsubscript{3} and brine, dried over MgSO\textsubscript{4}, filtered, and the volatiles were removed in vacuum. The residue was purified by column chromatography on silica gel (ethyl acetate/ petroleum ether 1:5) to give the corresponding products. All of the products were synthesized according to above described procedure.

1.3 Typical Procedure for the Synthesis of 3a.

\[
\text{HN}_3\text{S} + \text{SO}_2\text{Na} \xrightarrow{I_2 (1.25 \text{ eq.}) \text{ DMSO, 100 °C, 4h}} \text{O=S=O}
\]

The mixture of 6-methyl-4-phenylquinoline-2(1H)-thione 1a (0.2 mmol, 50 mg), sodium 4-methylbenzenesulfinate 2a (0.5 mmol, 89 mg) and I\textsubscript{2} (0.25 mmol, 26 mg) in DMSO (2 mL) was stirred at 100 °C for 4 hours under air atmosphere. After the reaction completed (monitored by TLC analysis),
saturated aq. Na$_2$SO$_3$ was added to the mixture to quench the reaction and extracted with ethyl acetate (3×25 mL). The combined organic layers were dried over MgSO$_4$, filtered, and the volatiles were removed in vacuum. The mixture was purified by using silica gel column chromatography (ethyl acetate: petroleum ether = 1:12). The corresponding product 3a was obtained as a white solid (65 mg, 87% yield).

3. Experimental details and characterization data for products

![6-methyl-4-phenyl-2-tosylquinoline](image)

6-methyl-4-phenyl-2-tosylquinoline (3a). White solid; mp 154-157 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ = 8.14 (d, $J$ = 8.8 Hz, 1H), 8.11 (s, 1H), 8.05 (d, $J$ = 8.4 Hz, 2H), 7.70 (s, 1H), 7.61 (dd, $J$ = 8.8, 8.8 Hz, 1H), 7.57-7.53 (m, 3H), 7.51-7.50 (m, 2H), 7.34 (d, $J$ = 8.4 Hz, 2H), 2.48 (s, 3H), 2.40 (s, 3H); $^{13}$C NMR (150 MHz, CDCl$_3$) $\delta$ = 157.0, 150.5, 146.7, 144.7, 139.6, 137.2, 136.4, 133.0, 130.5, 129.8, 129.5, 129.0, 128.8, 124.5, 117.8, 22.0, 21.6. HRMS (ESI) m/z: Calcd for C$_{23}$H$_{19}$NO$_2$S: 374.1209 [M+H]$^+$, Found: 374.1206.

![4-phenyl-2-tosylquinoline](image)

4-phenyl-2-tosylquinoline (3b). White solid; mp 131-133 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ = 8.23 (d, $J$ = 8.4 Hz, 1H), 8.16 (s, 1H), 8.07 (d, $J$ = 8.4 Hz, 2H), 7.95 (d, $J$ = 8.4 Hz, 1H), 7.78-7.74 (m, 1H), 7.60 – 7.48 (m, 6H), 7.34 (d, $J$ = 8.0 Hz, 2H), 2.39 (s, 3H); $^{13}$C NMR (150 MHz, CDCl$_3$) $\delta$ = 158.0, 151.5, 148.1, 144.8, 136.9, 136.2, 130.7, 130.7, 129.8, 129.5, 129.1, 129.1, 129.1, 128.8, 127.3, 125.9, 117.6, 21.7. HRMS (ESI) m/z: Calcd for C$_{22}$H$_{17}$NO$_2$S: 360.4505 [M+H]$^+$, Found: 360.4507.
7-methyl-4-phenyl-2-tosylquinoline (3c). White solid; mp 126-128 °C. $^1$H NMR (600 MHz, CDCl$_3$) δ = 8.07 (s, 1H), 8.04 (d, $J$ = 8.4 Hz, 2H), 8.01 (s, 1H), 7.83 (d, $J$ = 8.4 Hz, 1H), 7.52 (t, $J$ = 7.2 Hz, 3H), 7.49 – 7.47 (m, 2H), 7.41 (d, $J$ = 9.0 Hz, 1H), 7.33 (d, $J$ = 8.4 Hz, 2H), 2.54 (s, 3H), 2.40 (s, 3H); $^{13}$C NMR (150 MHz, CDCl$_3$) δ = 158.0, 151.1, 148.4, 144.6, 141.3, 137.1, 136.3, 131.4, 129.7, 129.6, 129.5, 129.1, 129.0, 128.7, 125.5, 125.4, 116.9, 21.6. HRMS (ESI) m/z: Calcd for C$_{23}$H$_{19}$NO$_2$S: 374.4775 [M+H]$^+$, Found: 374.4777.

8-methyl-4-phenyl-2-tosylquinoline (3d). White solid; mp 149-151 °C. $^1$H NMR (600 MHz, CDCl$_3$) δ = 8.15 (s, 1H), 8.09 (d, $J$ = 8.4 Hz, 2H), 7.77 (d, $J$ = 8.4 Hz, 1H), 7.59 (d, $J$ = 7.2 Hz, 1H), 7.53 – 7.51 (m, 3H), 7.49 – 7.44 (m, 3H), 7.35 (d, $J$ = 7.8 Hz, 2H), 2.73 (s, 3H), 2.42 (s, 3H); $^{13}$C NMR (150 MHz, CDCl$_3$) δ = 156.9, 151.5, 147.0, 144.7, 138.7, 137.4, 136.0, 130.6, 129.6, 129.5, 129.5, 128.9, 128.7, 128.7, 123.8, 116.8, 21.7, 17.9. HRMS (ESI) m/z: Calcd for C$_{23}$H$_{19}$NO$_2$S: 374.4775 [M+H]$^+$, Found: 374.4770.
6-ethyl-4-phenyl-2-tosylquinoline (3e). White solid; mp 155-157 °C. \(^{1}\)H NMR (400 MHz, CDCl\(_3\)) \(\delta = 8.16\) (d, \(J = 8.4\) Hz, 1H), 8.10 (s, 1H), 8.04 (d, \(J = 8.0\) Hz, 2H), 7.71 (s, 1H), 7.65 (d, \(J = 10.4\) Hz, 1H), 7.58 – 7.50 (m, 5H), 7.33 (d, \(J = 8.0\) Hz, 2H), 2.76 (q, \(J = 7.6\) Hz, 2H), 2.40 (s, 3H), 1.23 (t, \(J = 7.6\) Hz, 3H); \(^{13}\)C NMR (150 MHz, CDCl\(_3\)) \(\delta = 157.1, 150.7, 146.9, 145.8, 144.6, 137.2, 136.4, 131.9, 130.7, 129.7, 129.5, 129.0, 128.9, 128.7, 127.4, 123.3, 117.8, 29.2, 21.6, 15.3. HRMS (ESI) m/z: Calcd for C\(_{24}\)H\(_{21}\)NO\(_2\)S: 388.5045 [M+H]\(^+\), Found: 388.5049.

6-ethyl-4-(p-tolyl)-2-tosylquinoline (3f). White solid; mp 123-125 °C. \(^{1}\)H NMR (400 MHz, CDCl\(_3\)) \(\delta = 8.17\) (d, \(J = 8.8\) Hz, 1H), 8.10 (t, \(J = 2.4\) Hz, 1H), 8.05 (d, \(J = 8.0\) Hz, 2H), 7.76 (s, 1H), 7.67 – 7.64 (m, 1H), 7.43 – 7.32 (m, 7H), 2.77 (q, \(J = 7.6\) Hz, 2H), 2.49 (s, 3H), 2.41 (s, 3H), 1.24 (t, \(J = 7.6\) Hz, 3H); \(^{13}\)C NMR (151 MHz, CDCl\(_3\)) \(\delta = 157.1, 150.8, 146.9, 145.6, 144.6, 139.0, 136.5, 134.3, 131.8, 130.6, 129.7, 129.5, 128.9, 123.4, 117.8, 29.2, 21.6, 21.3, 15.3. HRMS (ESI) m/z: Calcd for C\(_{25}\)H\(_{23}\)NO\(_2\)S: 402.5315 [M+H]\(^+\), Found: 402.5317.

6-methoxy-4-phenyl-2-tosylquinoline (3g). White solid; mp 151-153 °C. \(^{1}\)H NMR (400 MHz, CDCl\(_3\)) \(\delta = 8.13\) (d, \(J = 9.2\) Hz, 1H), 8.09 (s, 1H), 8.04 (d, \(J = 8.4\) Hz, 2H), 7.58-7.51 (m, 5H), 7.43-7.40 (m, 1H), 7.33 (d, \(J = 8.0\) Hz, 2H), 7.20 (d, \(J = 2.0\) Hz, 1H), 3.78 (s, 3H), 2.40 (s, 3H); \(^{13}\)C NMR (151 MHz, CDCl\(_3\)) \(\delta = 159.9, 149.5, 144.6, 137.3, 136.6, 132.3, 129.7, 129.2, 129.0, 128.9, 128.9, 128.8, 123.5, 118.2, 103.3, 55.6, 21.6. HRMS (ESI) m/z: Calcd for C\(_{23}\)H\(_{19}\)NO\(_3\)S: 390.4765 [M+H]\(^+\), Found: 390.4768.
8-methoxy-4-phenyl-2-tosylquinoline (3h). White solid; mp 164-166 °C. $^1$H NMR (600 MHz, CDCl$_3$) $\delta =$ 8.11 (s, 1H), 8.08 (d, $J =$ 8.4 Hz, 2H), 7.52-7.48 (m, 3H), 7.46 – 7.42 (m, 4H), 7.31 (d, $J =$ 8.4 Hz, 2H), 7.04 (dd, $J =$ 6.3, 2.6 Hz, 1H), 4.02 (s, 3H), 2.37 (s, 3H); $^{13}$C NMR (150 MHz, CDCl$_3$) $\delta =$ 156.5, 156.3, 151.1, 144.6, 140.2, 137.3, 136.4, 129.7, 129.5, 129.2, 128.9, 128.7, 128.6, 118.2, 117.3, 109.3, 56.5, 21.6. HRMS (ESI) m/z: Calcd for C$_{23}$H$_{19}$NO$_3$S: 390.4765 [M+H]$^+$, Found: 390.4763.

4-phenyl-2-tosylbenzo[g]quinolone (3i). White solid; mp 179-181 °C. $^1$H NMR (600 MHz, CDCl$_3$) $\delta =$ 8.17 (s, 1H), 8.08 (d, $J =$ 8.4 Hz, 2H), 8.02 (d, $J =$ 9.0 Hz, 1H), 7.97 (d, $J =$ 9.0 Hz, 1H), 7.84 (d, $J =$ 7.8 Hz, 1H), 7.69 (d, $J =$ 8.4 Hz, 1H), 7.53 – 7.49 (m, 4H), 7.40-7.38 (m, 2H), 7.34 (d, $J =$ 8.4 Hz, 2H), 7.17–7.14 (m, 1H), 2.39 (s, 3H); $^{13}$C NMR (150 MHz, CDCl$_3$) $\delta =$ 156.5, 150.9, 149.7, 144.8, 141.6, 136.3, 133.7, 132.9, 129.8, 129.5, 129.1, 128.9, 128.8, 128.6, 128.4, 128.1, 127.9, 126.1, 125.6, 121.0, 21.7. HRMS (ESI) m/z: Calcd for C$_{26}$H$_{19}$NO$_2$S: 410.5105 [M+H]$^+$, Found: 410.5100.
6-butyl-4-phenyl-2-tosylquinoline (3j). White solid; mp 102-104 °C. $^1$H NMR (600 MHz, CDCl$_3$) δ = 8.15 (d, $J = 9.0$ Hz, 1H), 8.11 (s, 1H), 8.04 (d, $J = 8.4$ Hz, 2H), 7.71 (d, $J = 1.2$ Hz, 1H), 7.62 (dd, $J = 1.8$, 1.8 Hz, 1H), 7.56 – 7.49 (m, 5H), 7.31 (d, $J = 8.4$ Hz, 2H), 2.70 (t, $J = 7.8$ Hz, 2H), 2.37 (s, 3H), 1.60-1.55 (m, 2H), 1.33-1.27 (m, 2H), 0.87 (t, $J = 7.2$ Hz, 3H); $^{13}$C NMR (150 MHz, CDCl$_3$) δ = 157.1, 150.7, 146.9, 144.7, 144.5, 137.2, 136.5, 132.3, 130.6, 129.7, 129.5, 129.0, 128.8, 127.3, 124.0, 117.8, 35.9, 33.3, 22.3, 21.6, 13.8. HRMS (ESI) m/z: Calcd for C$_{26}$H$_{25}$NO$_2$S: 416.5585 [M+H]$^+$, Found: 416.5587.

6-butyl-(4-pentylphenyl)-2-tosylquinoline (3k). Colorless Oil. $^1$H NMR (600 MHz, CDCl$_3$) δ = 8.14 (d, $J = 9.0$ Hz, 1H), 8.10 (s, 1H), 8.04 (d, $J = 8.4$ Hz, 2H), 7.75 (s, 1H), 7.62 (dd, $J = 1.8$, 1.8 Hz, 1H), 7.43 (d, $J = 7.8$ Hz, 2H), 7.37 (d, $J = 8.4$ Hz, 2H), 7.31 (d, $J = 8.4$ Hz, 2H), 2.74-2.71 (m, 4H), 2.38 (s, 3H), 1.74-1.69 (m, 2H), 1.52-1.57 (m, 2H), 1.41-1.38 (m, 4H), 1.35-1.29 (m, 2H), 0.94 (t, $J = 7.8$ Hz, 3H), 0.89 (t, $J = 7.2$ Hz, 3H); $^{13}$C NMR (150 MHz, CDCl$_3$) δ = 157.1, 150.8, 146.9, 144.6, 144.3, 144.1, 136.5, 134.5, 132.2, 130.6, 129.7, 129.5, 128.9, 128.8, 127.4, 124.1, 117.8, 35.9, 35.7, 33.3, 31.6, 31.0, 22.6, 22.3, 21.6, 14.0, 13.8. HRMS (ESI) m/z: Calcd for C$_{31}$H$_{35}$NO$_2$S: 486.6935 [M+H]$^+$, Found: 486.6939.

6-chloro-4-phenyl-2-tosylquinoline (3l). White solid; mp 178-180 °C. $^1$H NMR (400 MHz, CDCl$_3$) δ = 8.32 (d, $J = 8.0$ Hz, 2H), 8.12 (m, 8.14-8.10, 2H), 7.82 (d, $J = 8.4$ Hz, 2H), 7.73 (s, 1H), 7.64 (d, $J = 9.6$ Hz, 1H), 7.60 – 7.50 (m, 5H), 2.49 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ = 158.3, 150.8, 146.4,
6-methyl-4-phenyl-2-(phenylsulfonyl)quinolone (3n). White solid; mp 171-173 °C. \(^1\)H NMR (600 MHz, CDCl\(_3\)) \(\delta = 8.17 – 8.15\) (m, 2H), 8.12 (d, \(J = 8.4\) Hz, 2H), 7.69 (s, 1H), 7.61 – 7.57 (m, 2H), 7.56 – 7.54 (m, 1H), 7.54-7.51 (m, 4H), 7.49 – 7.48 (m, 2H), 2.46 (s, 3H); \(^{13}\)C NMR (150 MHz, CDCl\(_3\)) \(\delta = 156.8, 150.6, 146.7, 139.8, 139.4, 137.1, 133.6, 133.1, 130.5, 129.5, 129.1, 129.0, 128.9, 128.8, 127.4, 124.6, 117.9, 22.0.\) HRMS (ESI) m/z: Calcd for C\(_{22}\)H\(_{26}\)ClNO\(_2\)S: 394.8925 [M+H]\(^+\), Found: 394.8921.

2-((4-methoxyphenyl)sulfonyl)-6-methyl-4-phenylquinoline (3o). White solid; mp 167-169 °C. \(^1\)H NMR (600 MHz, CDCl\(_3\)) \(\delta = 8.11\) (d, \(J = 6.0\) Hz, 1H), 8.09 (d, \(J = 2.4\) Hz, 1H), 8.07 (d, \(J = 1.8\) Hz, 2H), 7.68 (s, 1H), 7.60 (dd, \(J = 2.4, 1.8\) Hz, 1H), 7.56 – 7.52 (m, 3H), 7.49 – 7.48 (m, 2H), 7.00 – 6.98 (m, 2H), 3.84 (s, 3H), 2.46 (s, 3H); \(^{13}\)C NMR (150 MHz, CDCl\(_3\)) \(\delta = 163.8, 157.3, 150.5, 146.7, 139.5, 137.2, 132.9, 131.2, 130.8, 130.4, 129.5, 128.9, 128.7, 127.3, 124.5, 117.7, 114.3, 55.6, 22.0.\) HRMS (ESI) m/z: Calcd for C\(_{23}\)H\(_{19}\)NO\(_3\)S: 390.4765 [M+H]\(^+\), Found: 390.4761.
2-((4-chlorophenyl)sulfonyl)-6-methyl-4-phenylquinoline (3q). White solid; mp 166-168 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ = 8.10 (d, $J$ = 7.6 Hz, 4H), 7.70 (s, 1H), 7.63 (d, $J$ = 8.4 Hz, 1H), 7.56 (d, $J$ = 5.6 Hz, 3H), 7.51 (d, $J$ = 8.4 Hz, 4H), 2.48 (s, 3H); $^{13}$C NMR (150 MHz, CDCl$_3$) $\delta$ = 156.4, 150.8, 146.7, 140.4, 139.9, 137.7, 137.0, 133.2, 130.5, 129.5, 129.4, 129.0, 128.8, 127.5, 124.7, 117.7, 22.1. HRMS (ESI) m/z: Calcd for C$_{22}$H$_{26}$ClNO$_2$S: 394.8925 [M+H]$^+$, Found: 394.8929.

2-((2-fluorophenyl)sulfonyl)-6-methyl-4-phenylquinoline (3r). White solid; mp 168-170 °C. $^1$H NMR (600 MHz, CDCl$_3$) $\delta$ = 8.29 – 8.26 (m, 1H), 8.21 (s, 1H), 8.05 (d, $J$ = 8.4 Hz, 1H), 7.74 (s, 1H), 7.64 – 7.52 (m, 7H), 7.39-7.36 (m, 1H), 7.11 (t, $J$ = 9.6 Hz, 1H), 2.47 (s, 3H); $^{13}$C NMR (150 MHz, CDCl$_3$) $\delta$ 160.5, 158.8, 156.3, 150.6, 146.5, 139.9, 137.1, 136.3 (d, $J$ = 7.5 Hz), 133.1, 131.1, 130.4, 129.5, 129.0, 128.8, 127.7, 124.6, 124.6 (d, $J$ = 3.0 Hz), 118.0, 117.0 (d, $J$ = 21.0 Hz), 22.1; $^{19}$F NMR (376 MHz, CDCl$_3$) -107.8 (m). HRMS (ESI) m/z: Calcd for C$_{22}$H$_{16}$FNO$_2$S: 378.4409 [M+H]$^+$, Found: 378.4405.
7-methyl-1-phenyl-3-((4-(trifluoromethyl)phenyl)sulfonyl)naphthalene (3u). White solid; mp 178-180 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ = 8.22-8.18 (m, 2H), 8.12-8.01 (m, 2H), 7.63 (dd, $J = 8.8$, 8.8 Hz, 1H), 7.56-7.55 (m, 3H), 7.52 – 7.50 (m, 2H), 7.27 – 7.19 (m, 4H), 2.49 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 156.1, 151.0, 146.9, 143.0, 140.3, 137.1, 135.3 (q, $J = 33.0$ Hz), 133.5, 130.5, 129.8, 129.6, 129.3, 128.9, 127.7, 126.3 (q, $J = 4.0$ Hz), 124.8, 121.9, 117.8, 22.2.; $^{19}$F NMR (376 MHz, CDCl$_3$) -104.0 (s). HRMS (ESI) m/z: Calcd for C$_{23}$H$_{16}$F$_3$NO$_2$S: 428.4487 [M+H]$^+$, Found: 428.4481.

6-methyl-4-phenyl-2-(thiophen-2-ylsulfonyl)quinolone (3v). White solid; mp 143-146 °C. $^1$H NMR (600 MHz, CDCl$_3$) $\delta$ = 8.16 (d, $J = 9.0$ Hz, 1H), 8.10 (s, 1H), 7.91 (dd, $J = 1.2$, 1.8 Hz, 1H), 7.72 – 7.70 (m, 2H), 7.63 (dd, $J = 1.8$, 9.0 Hz, 1H), 7.57 – 7.53 (m, 3H), 7.51 – 7.49 (m, 2H), 7.13 (dd, $J = 4.2$, 4.8 Hz, 1H), 2.48 (s, 3H); $^{13}$C NMR (150 MHz, CDCl$_3$) $\delta$ = 156.7, 150.7, 146.6, 140.0, 139.8, 137.1, 135.2, 135.0, 133.1, 130.4, 129.5, 129.0, 128.8, 127.8, 127.5, 124.6, 117.4, 22.1. HRMS (ESI) m/z: Calcd for C$_{20}$H$_{15}$NO$_2$S$_2$: 366.4725 [M+H]$^+$, Found: 366.4723.

References
$^1$H NMR and $^{13}$C NMR Spectra of compound 3a (CDCl$_3$)
$^{1}H$ NMR and $^{13}C$ NMR Spectra of compound 3b (CDCl$_3$)
$^1$H NMR and $^{13}$C NMR Spectra of compound 3c (CDCl$_3$)}

$^1$H NMR and $^{13}$C NMR Spectra of compound 3d (CDCl$_3$)
$^{1}$H NMR and $^{13}$C NMR Spectra of compound 3e (CDCl$_3$)
$^1$H NMR and $^{13}$C NMR Spectra of compound 3f (CDCl$_3$)
$^1$H NMR and $^{13}$C NMR Spectra of compound 3g (CDCl$_3$)
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