Supporting Information

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1. General information:

All experiments were carried out under an atmosphere of air. Flash column chromatography was performed over silica gel 48-75 μm. \(^1\)H NMR and \(^{13}\)C NMR spectra were recorded on Bruker-AV (500 MHz and 126 MHz, respectively) instrument internally referenced to SiMe\(_4\) or chloroform signals. HRMS was recorded using waters G2-Xs qtof mass spectrometer. The new compounds were characterized by \(^1\)H NMR, \(^{13}\)C NMR, MS and HRMS. The structures of known compounds were further corroborated by comparing their \(^1\)H NMR, \(^{13}\)C NMR data and MS data with those of literature. The Substrates 1\(^{[1]}\) was synthesized according to the reported methods. All reagents and solvents were used as received from commercial sources without further purification.

2. Experimental procedures

a) General procedure: (E)-1-phenyl-3-(phenylsulfonyl)prop-2-en-1-one (3a):

A 10 mL oven-dried reaction vessel was charged with 1-phenylprop-2-yn-1-one (1a, 26.0 mg, 0.2 mmol), sodium benzosulfinate (2a, 65.7 mg, 0.4 mmol) and 4-chlorobenzoic acid (62.7 mg, 0.4 mmol). The reaction with mesitylene (2.0 mL) was added to the sealed reaction vessel by syringe. The resulting solution was stirred at 30 °C for 48 h. After cooling to room temperature, the volatiles were removed under vacuum and the residue was purified by column chromatography (petroleum ether/ethyl acetate = 5:1) to give 3aq as white solid; yield: 52.8 mg (97%, E:Z = 98:02).

b) Scaled-up Version of the

\[
\begin{align*}
\text{PhSO}_2\text{Na} & \quad \text{Mesitylene, } 30^\circ\text{C} \\
\text{1a} & \quad \text{2a} \\
10 \text{ mmol} & \quad 20 \text{ mmol} \\
\text{2.0 eq. PCBA} & \quad \text{3aa} \\
& \quad 2.21 \text{ g, 78% yield, E/Z = 95/05}
\end{align*}
\]

To a dried round bottle flask with a magnetic stirring bar were added the 1-phenylprop-2-yn-1-one 1a (10 mmol), sodium benzosulfinate 2a (20 mmol), and 4-chlorobenzoic acid (20 mmol), followed by the addition of mesitylene (50 mL). The reaction mixture was stirred at room temperature for 50 h. The solvent was removed under reduced pressure, and thereresidue was purified by column chromatography on silica gel to afford 3aa in 2.21 g (78% yield).
c) Procedure for the synthesis of derivative 6a

Under air, a stirred solution of 3fa (0.2 mmol) and Ph$_2$PCH$_3$ (0.04 mmol) in toluene (2 mL). Subsequently, ethyl buta-2,3-dienoate (0.24 mmol) was added in one portion. The reaction mixture was stirred for 24 h in room temperature, the solvents were removed in vacuo and the residue was directly purified by silica gel chromatography using petroleum ether/EtOAc as the eluent to afford the desired cycloaddition product 6fa.

d) Procedure for the synthesis of derivative 6b

A round-bottom flask was charged with 3aa (0.20 mmol), N$_2$H$_4$·H$_2$O (0.60 mmol) and EtOH (2 mL). The resultant mixture was allowed to react for 15 minutes under ultrasound irradiation (40 kHz / 50 W). Then the mixture was extracted with ethyl acetate (3 × 20 mL). The organic phase was dried over anhydrous Na$_2$SO$_4$, and the organic solvent was removed under reduced pressure. The crude products were purified by flash column chromatography to give the desired product 6b in 70% yield.

e) Procedure for the synthesis of derivative 6c

A round-bottom flask was charged with 3pa (0.30 mmol), N$_2$H$_4$·H$_2$O (4.5 mmol) and EtOH (10 mL).
mL). The resultant mixture was refluxed for 6 h, and then extracted with ethyl acetate (3 × 20 mL). The organic phase was dried over anhydrous Na$_2$SO$_4$, and the organic solvent was removed under reduced pressure. The crude products were purified by flash column chromatography to give the desired product 6c in 72% yield.

3. Control experiments$^a$
4. Characterization data of the products

$^a$ Reaction conditions: 1a (0.05 mmol), 2a (0.125 mmol), mesitylene (1.0 mL), 30 °C. The yield was determined by $^1$H NMR. E/Z ratio was determined by RP-HPLC.
(E)-1-phenyl-3-(phenylsulfonyl)prop-2-en-1-one (3aa)

\[
\begin{align*}
\text{O} & \quad \text{SO}_2\text{Ph} \\
\end{align*}
\]

m.p.: 105-109 °C; \(^1\)H NMR (500 MHz, CDCl\(_3\)) \(\delta\) 8.04 (d, \(J = 8.5\) Hz, 1H), 8.00-7.92 (m, 4H), 7.70-7.59 (m, 3H), 7.54 (t, \(J = 7.8\) Hz, 2H), 7.46 (d, \(J = 8.5\) Hz, 1H), 7.36 (d, \(J = 14.9\) Hz, 1H); \(^{13}\)C NMR (126 MHz, CDCl\(_3\)) \(\delta\) 187.63, 141.97, 138.56, 135.95, 134.51, 134.38, 133.03, 129.66, 129.09, 128.98, 128.29; IR: 3041, 1669, 1592, 1324, 1146, 1086 cm\(^{-1}\).

(E)-3-(phenylsulfonyl)-1-(p-tolyl)prop-2-en-1-one (3ba)

\[
\begin{align*}
\text{O} & \quad \text{SO}_2\text{Ph} \quad \text{H}_3\text{C} \\
\end{align*}
\]

The reaction was conducted with 1-(p-tolyl) prop-2-yn-1-one (1b, 28.4 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3ba as white solid; yield 98%, E:Z = 90:10.

m.p.: 116-120 °C; \(^1\)H NMR (500 MHz, CDCl\(_3\)) \(\delta\) 7.97-7.88 (m, 5H), 7.68 (t, \(J = 7.4\) Hz, 1H), 7.59 (t, \(J = 7.7\) Hz, 2H), 7.34 (dd, \(J = 18.4, 11.4\) Hz, 3H), 2.44 (s, 3H); \(^{13}\)C NMR (126 MHz, CDCl3) \(\delta\) 187.09, 145.81, 141.63, 138.72, 134.35, 133.57, 133.32, 129.82, 129.67, 129.16, 128.28, 21.89. HRMS (ESI) m/z calcd. for C\(_{16}\)H\(_{14}\)O\(_3\)NaS [M+Na]\(^+\) = 309.0561, found 309.0569; IR: 3058, 3027, 1661, 1315, 1155, 1089 cm\(^{-1}\).

(E)-1-(4-methoxyphenyl)-3-(phenylsulfonyl)prop-2-en-1-one (3ca)

\[
\begin{align*}
\text{O} & \quad \text{SO}_2\text{Ph} \quad \text{H}_3\text{CO} \\
\end{align*}
\]

The reaction was conducted with 1-(4-methoxyphenyl)prop-2-yn-1-one (1c, 32.0 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3ca as viscous liquid; yield 71%, E:Z = 81:19.
\( ^1\)H NMR (500 MHz, CDCl\(_3\)) \( \delta \) 7.93-7.85 (m, 5H), 7.61 (t, \( J = 7.4 \) Hz, 1H), 7.52 (t, \( J = 7.7 \) Hz, 2H), 7.28-7.19 (m, 1H), 6.92 (d, \( J = 8.9 \) Hz, 2H), 3.83 (s, 3H); \( ^{13}\)C NMR (126 MHz, CDCl\(_3\)) \( \delta \) 184.70, 163.71, 140.25, 137.83, 133.23, 132.37, 130.51, 128.60, 128.13, 127.22, 113.34, 54.65.

(E)-1-(4-(methylthio)phenyl)-3-(phenylsulfonyl)prop-2-en-1-one (3da)

![Chemical Structure](attachment:image.png)

The reaction was conducted with 1-(4-(methylthio)phenyl)prop-2-yn-1-one (1d, 35.3 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3da as yellow solid; yield 82%, E:Z = 94:06.

m.p.: 137-140 \( ^\circ \)C; \( ^1\)H NMR (500 MHz, CDCl\(_3\)) \( \delta \) 7.84 (dd, \( J = 28.5, 8.2 \) Hz, 5H), 7.60 (t, \( J = 7.1 \) Hz, 1H), 7.51 (t, \( J = 7.3 \) Hz, 2H), 7.28 (d, \( J = 14.8 \) Hz, 1H), 7.21 (d, \( J = 8.1 \) Hz, 2H), 2.45 (s, 3H); \( ^{13}\)C NMR (126 MHz, CDCl\(_3\)) \( \delta \) 186.22, 148.51, 141.64, 138.65, 134.39, 133.04, 132.14, 129.69, 129.36, 128.29, 125.06, 14.62. HRMS (ESI) m/z calcd. for C\(_{16}\)H\(_{14}\)O\(_3\)NS\(_2\) [M+Na]\(^+\) = 341.0282, found 341.0284; IR: 3047, 1656, 1586, 1320, 1148, 817 cm\(^{-1}\).

(E)-1-([1,1'-biphenyl]-4-yl)-3-(phenylsulfonyl)prop-2-en-1-one (3ea)

![Chemical Structure](attachment:image.png)

The reaction was conducted with 1-([1,1'-biphenyl]-4-yl)prop-2-yn-1-one (1e, 41.25 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3ea as yellow solid; yield 94%, E:Z = 83:17.

m.p.: 191-198 \( ^\circ \)C; \( ^1\)H NMR (500 MHz, CDCl\(_3\)) \( \delta \) 8.08-7.96 (m, 5H), 7.75 (d, \( J = 8.3 \) Hz, 2H), 7.70 (t, \( J = 7.5 \) Hz, 1H), 7.65 (d, \( J = 7.2 \) Hz, 2H), 7.60 (dd, \( J = 15.8, 8.1 \) Hz, 2H), 7.50 (t, \( J = 7.4 \) Hz, 2H), 7.46-7.38 (m, 2H); \( ^{13}\)C NMR (126 MHz, CDCl\(_3\)) \( \delta \) 187.10, 147.24, 141.92, 139.37, 138.63, 134.69, 134.43, 133.09, 129.72, 129.68, 129.12, 128.72, 128.34, 127.71, 127.38. HRMS (ESI) m/z
calcd. for C_{21}H_{16}O_{3}Na [M+Na]^+ = 371.0718, found 371.0722; IR: 2978, 1686, 1592, 1426, 1322, 1093 cm\(^{-1}\).

**(E)-1-((1,1'-biphenyl)-4-yl)-3-(phenylsulfonyl)prop-2-en-1-one (3fa)**

\[
\text{F} \quad \text{SO}_{2} \quad \text{Ph}
\]

The reaction was conducted with 1-(4-fluorophenyl)prop-2-yn-1-one (1f, 29.6 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (76.8 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3fa as yellow solid; yield 85%, E:Z = 95:05.

m.p.: 114-118 °C; \(^1\)H NMR (500 MHz, CDCl\(_3\)) \(\delta \) 8.05-8.03 (m, 2H), 7.96 (d, \(J = 7.8 \) Hz, 2H), 7.91 (d, \(J = 14.9 \) Hz, 1H), 7.70 (t, \(J = 7.4 \) Hz, 1H), 7.61 (t, \(J = 7.7 \) Hz, 2H), 7.37 (d, \(J = 14.9 \) Hz, 1H), 7.21 (t, \(J = 8.4 \) Hz, 2H); \(^{13}\)C NMR (126 MHz, CDCl\(_3\)) \(\delta \) 186.02, 166.54 (d, \(J = 257.8 \) Hz), 142.25, 138.58, 134.43, 132.68, 132.49 (d, \(J = 2.8 \) Hz), 131.81 (d, \(J = 9.8 \) Hz), 129.70, 128.32, 116.42 (d, \(J = 22.1 \) Hz); \(^{19}\)F NMR (471 MHz, CDCl\(_3\)) \(\delta \) -101.93. HRMS (ESI) m/z calcd. for C\(_{15}\)H\(_{11}\)O\(_3\)NaSF [M+Na]^+ = 313.0311, found 313.0317; IR: 3078, 1664, 1591, 1310, 1155, 837 cm\(^{-1}\).

**(E)-1-(4-chlorophenyl)-3-(phenylsulfonyl)prop-2-en-1-one (3ga)**

\[
\text{Cl} \quad \text{SO}_{2} \quad \text{Ph}
\]

The reaction was conducted with 1-(4-chlorophenyl)prop-2-yn-1-one (1g, 32.9 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) to give 3ga as white solid; yield 93%, E:Z = 97:03.

m.p.: 130-137 °C; \(^1\)H NMR (500 MHz, CDCl\(_3\)) \(\delta \) 7.97-7.89 (m, 5H), 7.70 (t, \(J = 7.3 \) Hz, 1H), 7.61 (t, \(J = 7.6 \) Hz, 2H), 7.51 (d, \(J = 8.4 \) Hz, 2H), 7.38 (d, \(J = 14.9 \) Hz, 1H); \(^{13}\)C NMR (126 MHz, CDCl\(_3\)) \(\delta \) 186.44, 142.44, 141.20, 138.47, 134.50, 134.31, 132.45, 130.37, 129.74, 129.50, 128.34; IR: 3045, 1683, 185, 1321, 1254, 1009 cm\(^{-1}\).
(E)-1-(4-bromophenyl)-3-(phenylsulfonyl)prop-2-en-1-one (3ha)

\[
\begin{align*}
&\text{Br} & \text{O} & \text{SO}_2\text{Ph} \\
&\text{The reaction was conducted with 1-(4-bromophenyl)prop-2-yn-1-one (1h, 41.8 mg, 0.2 mmol),} \\
&\text{sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and} \\
&\text{4-chlorobenzoic acid (62.6 mg, 0.4 mmol).} \\
&\text{The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3ha as white solid; yield 97%, E:Z = 98:02.} \\
&\text{m.p.: 140-144 °C; }^1\text{H NMR (500 MHz, CDCl}_3\text{) }\delta 7.88 (d, J = 7.7 Hz, 2H), 7.79 (dd, J = 13.9, 11.9 \text{ Hz, 3H}), 7.61 (dd, J = 16.1, 7.9 Hz, 3H), 7.53 (t, J = 7.7 Hz, 2H), 7.31-7.19 (m, 1H); ^{13}\text{C NMR (126 MHz, CDCl}_3\text{) }\delta 185.63, 141.47, 137.50, 133.70, 133.42, 131.45, 131.38, 129.33, 128.99, 128.67, 127.29. \\
&\text{HRMS (ESI) m/z calcd. for C}_{15}\text{H}_{12}\text{O}_3\text{SBr [M+H]}^+ = 350.9691, found 350.9686; IR: 3043, 1685, 1580, 1321, 1154, 999 cm}^{-1}.
\end{align*}
\]

(E)-1-(4-iodophenyl)-3-(phenylsulfonyl)prop-2-en-1-one (3ia)

\[
\begin{align*}
&\text{O} & \text{SO}_2\text{Ph} \\
&\text{The reaction was conducted with 1-(4-iodophenyl)prop-2-yn-1-one (1i, 51.2 mg, 0.2 mmol),} \\
&\text{sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol).} \\
&\text{The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) to give 3i as white solid; yield 86%, E:Z = 85:15.} \\
&\text{m.p.: 165-170 °C; }^1\text{H NMR (500 MHz, CDCl}_3\text{) }\delta 7.88 (d, J = 6.4 Hz, 2H), 7.81 (t, J = 10.8 Hz, 3H), 7.62 (d, J = 6.6 Hz, 3H), 7.53 (s, 2H), 7.32-7.19 (m, 1H); ^{13}\text{C NMR (126 MHz, CDCl}_3\text{) }\delta 187.01, 142.48, 138.48, 138.24, 135.23, 134.51, 132.34, 130.16, 129.74, 128.35, 103.15. \\
&\text{HRMS (ESI) m/z calcd. for C}_{15}\text{H}_{11}\text{O}_3\text{NaSI [M+Na]}^+ = 420.9371, found 420.9377; IR: 3034, 1682, 1575, 1320, 1149, 1001 cm}^{-1}.
\end{align*}
\]

(E)-1-(4-(dimethylamino)phenyl)-3-(phenylsulfonyl)prop-2-en-1-one (3ja)

\[
\begin{align*}
&\text{O} & \text{SO}_2\text{Ph} \\
&\text{The reaction was conducted with 1-(4-(dimethylamino)phenyl)prop-2-yn-1-one (1j, 51.2 mg, 0.2 mmol),} \\
&\text{sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol).} \\
&\text{The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) to give 3j as white solid; yield 86%, E:Z = 85:15.} \\
&\text{m.p.: 165-170 °C; }^1\text{H NMR (500 MHz, CDCl}_3\text{) }\delta 7.88 (d, J = 6.4 Hz, 2H), 7.81 (t, J = 10.8 Hz, 3H), 7.62 (d, J = 6.6 Hz, 3H), 7.53 (s, 2H), 7.32-7.19 (m, 1H); ^{13}\text{C NMR (126 MHz, CDCl}_3\text{) }\delta 187.01, 142.48, 138.48, 138.24, 135.23, 134.51, 132.34, 130.16, 129.74, 128.35, 103.15. \\
&\text{HRMS (ESI) m/z calcd. for C}_{15}\text{H}_{11}\text{O}_3\text{NaSI [M+Na]}^+ = 420.9371, found 420.9377; IR: 3034, 1682, 1575, 1320, 1149, 1001 cm}^{-1}.
\end{align*}
\]
The reaction was conducted with 1-(4-(dimethylamino)phenyl)prop-2-yn-1-one (1j, 34.7 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3ja as red solid; yield 73%, E:Z = 82:18.

m.p.: 45-58 °C; \(^1\)H NMR (500 MHz, CDCl\(_3\)) \(\delta\) 7.99-7.91 (m, 5H), 7.67 (t, \(J = 7.2\) Hz, 1H), 7.58 (t, \(J = 7.5\) Hz, 2H), 7.34 -7.27 (m, 1H), 6.67 (d, \(J = 8.7\) Hz, 2H), 3.10 (s, 6H); \(^{13}\)C NMR (126 MHz, CDCl\(_3\)) \(\delta\) 184.09, 154.26, 139.87, 139.10, 134.14, 134.12, 131.61, 129.57, 128.80, 128.18, 124.01, 111.00, 40.11. HRMS (ESI) m/z calcd. for C\(_{17}\)H\(_{17}\)NO\(_3\)NaS \[M+Na\]^+ = 338.0827, found 338.0833; IR: 2924, 1684, 1593, 1322, 1176, 853 cm\(^{-1}\).

(E)-3-(phenylsulfonyl)-1-(4-(trifluoromethyl)phenyl)prop-2-en-1-one (3ka)

The reaction was conducted with 1-(4-(trifluoromethyl)phenyl)prop-2-yn-1-one (1k, 39.6 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3ka as yellow solid; yield 95%, E:Z = 98:02.

m.p.: 146-150 °C; \(^1\)H NMR (500 MHz, CDCl\(_3\)) \(\delta\) 8.10 (d, \(J = 7.8\) Hz, 2H), 7.95 (d, \(J = 21.2\), 11.5 Hz, 4H), 7.79 (d, \(J = 7.9\) Hz, 2H), 7.61 (t, \(J = 7.4\) Hz, 2H), 7.42 (d, \(J = 14.9\) Hz, 1H); \(^{13}\)C NMR (126 MHz, CDCl\(_3\)) \(\delta\) 186.95, 143.05, 138.60, 138.36, 135.46 (d, \(J = 32.9\) Hz), 134.57, 132.21, 129.76, 129.30, 128.36, 126.14 (q, \(J = 3.8\) Hz), 123.35 (q, \(J = 273.0\) Hz); \(^{19}\)F NMR (471 MHz, CDCl\(_3\)) \(\delta\) -63.22; HRMS (ESI) m/z calcd. for C\(_{16}\)H\(_{11}\)O\(_3\)NaF\(_3\) \[M+Na\]^+ = 363.0279, found 363.0273; IR: 3045, 1671, 1415, 1319, 1131, 751 cm\(^{-1}\).
The reaction was conducted with 1-(2-nitrophenyl)prop-2-yn-1-one (1l, 35.0 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 2:1) to give 3la as white solid; yield 71%, E:Z = 97:03.

m.p.: 121-128 °C; \textsuperscript{1}H NMR (500 MHz, CDCl\textsubscript{3}) δ 8.18 (d, \textit{J} = 8.2 Hz, 1H), 7.90 (d, \textit{J} = 7.7 Hz, 2H), 7.80 (t, \textit{J} = 7.5 Hz, 1H), 7.71 (dd, \textit{J} = 11.9, 7.5 Hz, 2H), 7.60 (t, \textit{J} = 7.8 Hz, 2H), 7.48 (d, \textit{J} = 7.5 Hz, 1H), 7.29-7.26 (m, 1H), 7.04 (d, \textit{J} = 15.3 Hz, 1H); \textsuperscript{13}C NMR (126 MHz, CDCl\textsubscript{3}) δ 189.52, 146.20, 141.24, 138.18, 135.71, 134.90, 134.81, 134.59, 132.00, 129.76, 128.82, 128.34, 124.76. HRMS (ESI) \textit{m/z} calcd. for C\textsubscript{15}H\textsubscript{11}NO\textsubscript{5}SNa [M+Na]\textsuperscript{+} = 340.0256, found 340.0264; IR: 3054, 1692, 1523, 1348, 1150, 794 cm\textsuperscript{-1}.

(E)-1-(anthracen-9-yl)-3-(phenylsulfonyl)prop-2-en-1-one (3ma)

The reaction was conducted with 1-(anthracen-9-yl)prop-2-yn-1-one (1m, 46.1 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3ma as red solid; yield 94%, E:Z = 98:02.

m.p.: 112-122 °C; \textsuperscript{1}H NMR (500 MHz, CDCl\textsubscript{3}) δ 8.56 (s, 1H), 8.05-8.03 (m, 2H), 7.86 (d, \textit{J} = 7.6 Hz, 2H), 7.76-7.74 (m, 2H), 7.66 (t, \textit{J} = 7.3 Hz, 1H), 7.56-7.48 (m, 7H), 7.07 (d, \textit{J} = 15.3 Hz, 1H); \textsuperscript{13}C NMR (126 MHz, CDCl\textsubscript{3}) δ 196.41, 142.94, 138.38, 137.90, 134.48, 131.95, 130.94, 130.59, 129.68, 129.07, 128.40, 128.31, 127.69, 125.81, 124.28. HRMS (ESI) \textit{m/z} calcd. for C\textsubscript{23}H\textsubscript{16}O\textsubscript{3}SNa [M+Na]\textsuperscript{+} = 395.0718, found 395.0713; IR: 2923, 1679, 1592, 1284, 1092, 762 cm\textsuperscript{-1}.

(E)-3-(phenylsulfonyl)-1-(o-tolyl)prop-2-en-1-one (3na)
The reaction was conducted with 1-(o-tolyl)prop-2-yne-1-one (1n, 28.8 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3na as white solid; yield 82%, E:Z = 95:05.

m.p.: 82-84 °C; \( ^1 \)H NMR (500 MHz, CDCl\(_3\)) \( \delta \) 7.95 (d, \( J = 7.8 \) Hz, 2H), 7.71-7.58 (m, 5H), 7.46 (t, \( J = 7.4 \) Hz, 1H), 7.33-7.27 (m, 2H), 7.22 (d, \( J = 15.0 \) Hz, 1H), 2.48 (s, 3H); \( ^{13} \)C NMR (126 MHz, CDCl\(_3\)) \( \delta \) 191.07, 141.73, 139.41, 138.61, 136.14, 135.88, 134.42, 132.80, 132.27, 129.78, 129.70, 128.31, 126.02, 21.19. HRMS (ESI) m/z calcld. for C\(_{16}\)H\(_{14}\)O\(_3\)Na \([M+Na]^+\) = 309.0561, found 309.0560; IR: 3038, 1673, 1600, 1306, 1147, 970 cm\(^{-1}\).

(E)-3-(phenylsulfonyl)-1-(m-tolyl)prop-2-en-1-one (3oa)

The reaction was conducted with 1-(m-tolyl)prop-2-yne-1-one (1o, 28.8 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3oa as yellow solid; yield 94%, E:Z = 95:05.

m.p.: 94-100 °C; \( ^1 \)H NMR (500 MHz, CDCl\(_3\)) \( \delta \) 7.96 (dd, \( J = 10.7, 5.9 \) Hz, 3H), 7.79 (d, \( J = 8.4 \) Hz, 2H), 7.69 (t, \( J = 7.1 \) Hz, 1H), 7.60 (t, \( J = 7.5 \) Hz, 2H), 7.46 (d, \( J = 7.2 \) Hz, 1H), 7.43-7.35 (m, 2H), 2.43 (s, 3H); \( ^{13} \)C NMR (126 MHz, CDCl\(_3\)) \( \delta \) 187.74, 141.79, 139.10, 138.63, 136.01, 135.38, 134.41, 133.27, 129.70, 129.46, 128.99, 128.31, 126.28, 21.39. HRMS (ESI) m/z calcld. for C\(_{16}\)H\(_{14}\)O\(_3\)Na \([M+Na]^+\) = 309.0561, found 309.0562; IR: 3037, 1663, 1592, 1284, 1144, 837 cm\(^{-1}\).

(E)-1-(2-cyclopropyl-4-(4-fluorophenyl)quinolin-3-yl)-3-(phenylsulfonyl)prop-2-en-1-one (3pa)
The reaction was conducted with 1-(2-cyclopropyl-4-(4-fluorophenyl)quinolin-3-yl)prop-2-yn-1-one (1p, 63.1 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3pa as yellow solid; yield 87%, E:Z = 97:03.

m.p.: 133-140 °C; 1H NMR (500 MHz, CDCl₃) δ 7.99 (d, J = 8.4 Hz, 1H), 7.70 (t, J = 8.7 Hz, 4H), 7.57 (t, J = 7.6 Hz, 2H), 7.51 (d, J = 8.3 Hz, 1H), 7.40 (t, J = 7.5 Hz, 1H), 7.17 (dd, J = 8.0, 5.4 Hz, 2H), 7.05 (t, J = 8.4 Hz, 2H), 6.83 (d, J = 3.1 Hz, 1H), 2.01-1.96 (m, 1H), 1.32 (dd, J = 6.5, 3.7 Hz, 2H), 0.98-0.95 (m, 2H); 13C NMR (126 MHz, CDCl₃) δ 194.89, 163.05 (d, J = 250.1 Hz), 158.36, 148.41, 144.45, 142.19, 138.41, 136.69, 134.44, 132.10 (d, J = 8.3 Hz), 131.55, 130.76, 130.60 (d, J = 3.5 Hz), 129.63, 129.30, 128.32, 126.52, 125.80, 124.46, 115.97 (d, J = 21.5 Hz), 15.58, 10.93; 19F NMR (471 MHz, CDCl₃) δ -110.94; HRMS (ESI) m/z calcd. for C_{27}H_{21}NO_{3}SF [M+H]⁺ = 458.1226, found 458.1235; IR: 3047, 1662, 1512, 1327, 1159, 848 cm⁻¹.

(E)-4-(phenylsulfonyl)but-3-en-2-one (3qa)¹²

m.p.: 133-140 °C; 1H NMR (500 MHz, CDCl₃) δ 7.99 (d, J = 8.4 Hz, 1H), 7.70 (t, J = 8.7 Hz, 4H), 7.57 (t, J = 7.6 Hz, 2H), 7.51 (d, J = 8.3 Hz, 1H), 7.40 (t, J = 7.5 Hz, 1H), 7.17 (dd, J = 8.0, 5.4 Hz, 2H), 7.05 (t, J = 8.4 Hz, 2H), 6.83 (d, J = 3.1 Hz, 1H), 2.01-1.96 (m, 1H), 1.32 (dd, J = 6.5, 3.7 Hz, 2H), 0.98-0.95 (m, 2H); 13C NMR (126 MHz, CDCl₃) δ 194.89, 163.05 (d, J = 250.1 Hz), 158.36, 148.41, 144.45, 142.19, 138.41, 136.69, 134.44, 132.10 (d, J = 8.3 Hz), 131.55, 130.76, 130.60 (d, J = 3.5 Hz), 129.63, 129.30, 128.32, 126.52, 125.80, 124.46, 115.97 (d, J = 21.5 Hz), 15.58, 10.93; 19F NMR (471 MHz, CDCl₃) δ -110.94; HRMS (ESI) m/z calcd. for C_{27}H_{21}NO_{3}SF [M+H]⁺ = 458.1226, found 458.1235; IR: 3047, 1662, 1512, 1327, 1159, 848 cm⁻¹.

The reaction was conducted with but-3-yn-2-one (1q, 13.6 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3qa as yellow solid; yield 65%, E:Z = 97:03.

m.p.: 50-55 °C; 1H NMR (500 MHz, CDCl₃) δ 7.96-7.90 (m, 2H), 7.70 (t, J = 7.5 Hz, 1H), 7.61 (d, J = 7.9 Hz, 2H), 7.14 (d, J = 15.4 Hz, 1H), 7.02 (d, J = 15.4 Hz, 1H), 2.36 (s, 3H); 13C NMR (126
MHz, CDCl$_3$) $\delta$ 195.51, 141.00, 138.52, 136.06, 134.45, 129.69, 128.33, 29.12; IR: 3045, 1692, 1448, 1320, 1148, 757 cm$^{-1}$.

(E)-1-phenyl-3-tosylprop-2-en-1-one (3ab)$^2$

\[
\begin{align*}
\text{The reaction was conducted with 1-phenylprop-2-yn-1-one (1a, 26.0 mg, 0.2 mmol), sodium 4-} \\
\text{methylbenzenesulfinate (2b, 89 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol).} \\
\text{The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate =} \\
\text{4:1) to give 3ab as yellow solid; yield 70%, E:Z = 94:06.} \\
\text{m.p.: 94-100 °C; }^1\text{H NMR (500 MHz, CDCl$_3$) }\delta 7.98 (d, J = 7.8 Hz, 2H), 7.90 (d, J = 14.9 Hz, 1H), \\
7.83 (d, J = 8.1 Hz, 2H), 7.64 (t, J = 7.4 Hz, 1H), 7.52 (t, J = 7.7 Hz, 2H), 7.36 (dd, J = 15.4, 11.6 \\
\text{Hz, 3H), 2.45 (s, 3H); }^{13}\text{C NMR (126 MHz, CDCl$_3$) }\delta 187.77, 145.61, 142.33, 136.08, 135.70, \\
134.41, 132.66, 130.31, 129.07, 128.96, 128.34, 21.73; \text{IR: 3045, 1668, 1313, 1148, 1003, 981 cm}^{-1}.
\end{align*}
\]

(E)-3-((4-(tert-butyl)phenyl)sulfonyl)-1-phenylprop-2-en-1-one (3ac)

\[
\begin{align*}
\text{The reaction was conducted with 1-phenylprop-2-yn-1-one (1a, 26.0 mg, 0.2 mmol), sodium 4-} \\
\text{(tert-butyl)benzenesulfinate (2c, 55.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol).} \\
\text{The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate =} \\
\text{5:1) to give 3ac as white solid; yield 60%, E:Z = 89:11.} \\
\text{m.p.: 123-128 °C; }^1\text{H NMR (500 MHz, CDCl$_3$) }\delta 7.92-7.75 (m, 5H), 7.58 (t, J = 7.4 Hz, 1H), 7.53- \\
7.44 (m, 4H), 7.3007.18 (m, 1H), 1.28 (s, 9H); \text{IR: 3045, 1668, 1313, 1148, 1003, 981 cm}^{-1}.
\end{align*}
\]
29.99; HRMS calcd. for: C_{19}H_{20}O_{3}NaS [M+Na]^{+} = 351.1031, found 351.01035; IR: 2963, 1693, 1671, 1447, 1196, 690 cm\(^{-1}\).

**(E)-3-((4-methoxyphenyl)sulfonyl)-1-phenylprop-2-en-1-one (3ad)**

![Image of chemical structure](image)

The reaction was conducted with 1-phenylprop-2-yn-1-one (1a, 26.0 mg, 0.2 mmol), sodium 4-methoxybenzenesulfinate (2d, 48.5 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3ad as yellow solid; yield 61%, E:Z = 86:14.

m.p.: 88-93 °C; \(^{1}\)H NMR (500 MHz, CDCl\(_3\)) \(\delta\) 7.99 (d, \(J = 7.7\) Hz, 2H), 7.89-7.86 (m, 3H), 7.65 (t, \(J = 7.4\) Hz, 1H), 7.53 (t, \(J = 7.7\) Hz, 2H), 7.36-7.26 (m, 1H), 7.04 (d, \(J = 8.8\) Hz, 2H), 3.90 (s, 3H); \(^{13}\)C NMR (126 MHz, CDCl\(_3\)) \(\delta\) 187.89, 164.38, 142.59, 136.13, 134.39, 132.09, 130.64, 129.96, 129.07, 128.97, 114.94, 55.82; IR: 3063, 1685, 1665, 1592, 1268, 762 cm\(^{-1}\).

**(E)-1-phenyl-3-((4-(trifluoromethoxy)phenyl)sulfonyl)prop-2-en-1-one (3ae)**

![Image of chemical structure](image)

The reaction was conducted with 1-phenylprop-2-yn-1-one (1a, 26.0 mg, 0.2 mmol), sodium 4-(trifluoromethoxy)benzenesulfinate (2e, 124.0 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) to give 3ae as white solid; yield 70%, E:Z = 95:05.

m.p.: 114-120 °C; \(^{1}\)H NMR (500 MHz, CDCl\(_3\)) \(\delta\) 8.03-7.95 (m, 5H), 7.68-7.65 (m, 1H), 7.54 (t, \(J = 7.8\) Hz, 2H), 7.41 (d, \(J = 8.2\) Hz, 2H), 7.36 (d, \(J = 14.9\) Hz, 1H); \(^{13}\)C NMR (126 MHz, CDCl\(_3\)) \(\delta\) 187.44, 153.48, 153.47, 141.49, 136.94, 135.91, 134.61, 133.78, 130.68, 129.15, 129.02, 121.36; \(^{19}\)F NMR (471 MHz, CDCl\(_3\)) \(\delta\) -57.64; HRMS calcd. for: C\(_{16}\)H\(_{11}\)O\(_4\)NaSF\(_3\) [M+Na]\(^{+}\) = 379.0228, found 379.0223; IR: 3052, 2320, 1670, 1270, 1151, 1006 cm\(^{-1}\).
(E)-3-(mesitylsulfonyl)-1-phenylprop-2-en-1-one (3af)

\[
\begin{align*}
&\text{The reaction was conducted with 1-phenylprop-2-yn-1-one (1a, 26.0 mg, 0.2 mmol), sodium} \\
&\text{2,4,6-trimethylbenzenesulfinate (2f, 103.0 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4} \\
&\text{mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3af as white solid; yield 73\%, E:Z = 91:09.} \\
&\text{m.p.: 95-105 °C; }^1\text{H NMR (500 MHz, CDCl}_3\text{) }\delta \text{ 7.99-7.98 (m, 2H), 7.88 (d, }J = 14.9 \text{ Hz, 1H),} \\
&\text{7.65 (t, }J = 7.4 \text{ Hz, 1H), 7.53 (t, }J = 7.8 \text{ Hz, 2H), 7.41 (d, }J = 14.9 \text{ Hz, 1H), 6.99 (s, 2H), 2.65 (s,} \\
&\text{6H), 2.32 (s, 3H); }^{13}\text{C NMR (126 MHz, CDCl}_3\text{) }\delta \text{ 187.96, 144.42, 142.53, 140.55, 136.18, 134.40,} \\
&\text{132.53, 131.86, 131.56, 129.09, 128.94, 22.97, 21.13; HRMS calcd. for: C}_{18}\text{H}_{18}\text{O}_3\text{NaS [M+Na] }^+ \\
&\text{= 337.0874, found 337.0876; IR: 3040, 1666, 1447, 1318, 1075, 694 cm}^{-1}. \\
\end{align*}
\]

(E)-3-((4-fluorophenyl)sulfonyl)-1-phenylprop-2-en-1-one (3ag)

\[
\begin{align*}
&\text{The reaction was conducted with 1-phenylprop-2-yn-1-one (1a, 26.0 mg, 0.2 mmol), sodium} \\
&\text{4-fluorobenzenesulfinate (2g, 45.5 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol).} \\
&\text{The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3ag as yellow solid; yield 67\%, E:Z = 93:07.} \\
&\text{m.p.: 92-100 °C; }^1\text{H NMR (500 MHz, CDCl}_3\text{) }\delta \text{ 8.00-7.92 (m, 5H), 7.67 (t, }J = 7.2 \text{ Hz, 1H),} \\
&\text{7.54 (t, }J = 7.7 \text{ Hz, 2H), 7.34 (d, }J = 14.9 \text{ Hz, 1H), 7.27 (dd, }J = 11.3, 5.2 \text{ Hz, 2H); }^{13}\text{C NMR (126} \\
&\text{MHz, CDCl}_3\text{) }\delta \text{ 187.55, 166.25 (d, }J = 258.1 \text{ Hz), 141.81, 135.96, 134.56, 133.28, 131.32, 131.24,} \\
&\text{129.13, 129.00, 117.09 (d, }J = 22.8 \text{ Hz); }^{19}\text{F NMR (471 MHz, CDCl}_3\text{) }\delta \text{ -101.93; HRMS calcd.} \\
&\text{for: C}_{13}\text{H}_{18}\text{O}_3\text{NaSF [M+Na] }^+ \text{ = 313.0311, found 313.0317; IR: 3054, 1668, 1590, 1322, 1146,} \\
&\text{838 cm}^{-1}. \\
\end{align*}
\]
(E)-3-((4-chlorophenyl)sulfonyl)-1-phenylprop-2-en-1-one (3ah)

The reaction was conducted with 1-phenylprop-2-yn-1-one (1a, 26.0 mg, 0.2 mmol), sodium 4-chlorobenzenesulfinate (2h, 49.7 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3ah as yellow solid; yield 72%, E:Z = 80:20.

m.p.: 102-110 °C; ¹H NMR (500 MHz, CDCl₃) δ 8.00-7.98 (m, 1H), 7.96-7.89 (m, 3H), 7.67 (dd, J = 10.6, 4.2 Hz, 1H), 7.58-7.52(m, 4H), 7.35 (d, J = 14.9 Hz, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 187.47, 141.59, 141.31, 137.19, 135.93, 134.58, 133.58, 130.05, 129.77, 129.14, 129.00; IR: 3054, 1672, 1449, 1317, 1141, 1083 cm⁻¹.

(E)-3-((4-bromophenyl)sulfonyl)-1-phenylprop-2-en-1-one (3ai)

The reaction was conducted with 1-phenylprop-2-yn-1-one (1a, 26.0 mg, 0.2 mmol), sodium 4-bromobenzenesulfinate (2i, 121.5 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3ai as white solid; yield 51%, E:Z = 52:48.

m.p.: 97-105 °C; ¹H NMR (500 MHz, CDCl₃) δ 7.91 (d, J = 7.6 Hz, 2H), 7.86 (d, J = 14.9 Hz, 1H), 7.74 (d, J = 8.5 Hz, 2H), 7.66 (d, J = 8.5 Hz, 2H), 7.58 (t, J = 7.4 Hz, 1H), 7.46 (t, J = 7.7 Hz, 2H), 7.27 (s, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 186.43, 140.51, 136.73, 134.91, 133.53, 132.62, 132.00, 128.88, 128.75, 128.10, 127.96; IR: 3051, 1667, 1573, 1389, 1321, 967 cm⁻¹.

(E)-3-((4-iodophenyl)sulfonyl)-1-phenylprop-2-en-1-one (3aj)
The reaction was conducted with 1-phenylprop-2-yn-1-one (1a, 26.0 mg, 0.2 mmol), sodium 4-iodobenzenesulfinate (2j, 145.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3aj as white solid; yield 85%, E:Z = 94:06.

m.p.: 114-124 °C; 1H NMR (500 MHz, CDCl3) δ 7.99-7.91 (m, 5H), 7.66-7.64 (m, 3H), 7.53 (t, J = 7.8 Hz, 2H), 7.33 (d, J = 14.9 Hz, 1H); 13C NMR (126 MHz, CDCl3) δ 187.46, 141.54, 139.00, 138.42, 135.95, 134.55, 129.53, 129.13, 128.99, 102.58; HRMS calcd. for: C15H11O3NaSI [M+Na]+ = 420.9371, found 420.9370; IR: 3041, 1669, 1563, 1320, 1142, 818 cm⁻¹.

(E)-1-phenyl-3-((4-(trifluoromethyl)phenyl)sulfonyl)prop-2-en-1-one (3ak)

The reaction was conducted with 1-phenylprop-2-yn-1-one (1a, 26.0 mg, 0.2 mmol), sodium 4-(trifluoromethyl)benzenesulfinate (2k, 116.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) to give 3ak as yellow solid; yield 83%, E:Z = 80:20.

m.p.: 122-127 °C; 1H NMR (500 MHz, CDCl3) δ 8.10 (d, J = 8.2 Hz, 2H), 8.01-7.99 (m, 3H), 7.87 (d, J = 8.2 Hz, 2H), 7.67 (t, J = 7.4 Hz, 1H), 7.55 (t, J = 7.7 Hz, 2H), 7.35 (d, J = 14.9 Hz, 1H); 13C NMR (126 MHz, CDCl3) δ 187.26, 142.35, 141.05, 135.98 (q, J = 34.2 Hz), 135.84, 134.67, 134.49, 129.18, 129.02, 128.92, 126.82 (q, J = 3.6 Hz), 123.00 (q, J = 273.1 Hz); 19F NMR (471 MHz, CDCl3) δ -63.28; HRMS calced. for: C16H12O3NaSSF3 [M+H]+ = 363.0279, found 363.0285; IR: 3052, 1668, 1325, 1152, 1063, 714 cm⁻¹.

(E)-3-((4-nitrophenyl)sulfonyl)-1-phenylprop-2-en-1-one (3al, CAS: 100961-84-0)

m.p.: 164-166 °C; 1H NMR (500 MHz, CDCl3) δ 8.11 (d, J = 8.2 Hz, 2H), 8.01-7.99 (m, 3H), 7.87 (d, J = 8.2 Hz, 2H), 7.67 (t, J = 7.4 Hz, 1H), 7.55 (t, J = 7.7 Hz, 2H), 7.35 (d, J = 14.9 Hz, 1H); 13C NMR (126 MHz, CDCl3) δ 187.26, 142.35, 141.05, 135.98 (q, J = 34.2 Hz), 135.84, 134.67, 134.49, 129.18, 129.02, 128.92, 126.82 (q, J = 3.6 Hz), 123.00 (q, J = 273.1 Hz); 19F NMR (471 MHz, CDCl3) δ -63.28; HRMS calced. for: C16H12O3NaSSF3 [M+H]+ = 363.0279, found 363.0285; IR: 3052, 1668, 1325, 1152, 1063, 714 cm⁻¹.
The reaction was conducted with 1-phenylprop-2-yn-1-one (1a, 26.0 mg, 0.2 mmol), sodium 4-nitrobenzenesulfinate (2l, 104.6 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 3:1) to give 3al as white solid; yield 85%, E:Z = 55:45.

\[ \text{m.p.: 137-146 °C; } \text{H} NMR (500 MHz, CDCl}_3 \delta 8.36 (d, J = 8.7 Hz, 2H), 8.10 (d, J = 8.7 Hz, 2H), 7.95 (dd, J = 19.8, 11.2 Hz, 3H), 7.61 (t, J = 7.4 Hz, 1H), 7.48 (t, J = 7.7 Hz, 2H), 7.29 (d, J = 14.9 Hz, 1H); \text{C} NMR (126 MHz, CDCl}_3 \delta 187.05, 151.10, 144.42, 140.54, 135.71, 135.19, 134.83, 129.76, 129.24, 129.06, 124.85; IR: 3049, 1685, 1592, 1324, 1284, 853 cm\(^{-1}\).

\((E)-3-((2\text{-chlorophenyl})sulfonyl)-1\text{-phenylprop-2-en-1-one (3am)}\)

The reaction was conducted with 1-phenylprop-2-yn-1-one (1a, 26.0 mg, 0.2 mmol), sodium 2-chlorobenzenesulfinate (2m, 99.3 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) to give 3am as white solid; yield 77%, E:Z = 98:02.

\[ \text{m.p.: 129-134 °C; } \text{H} NMR (500 MHz, CDCl}_3 \delta 8.21 (d, J = 7.2 Hz, 1H), 8.03 (dd, J = 24.1, 11.0 Hz, 3H), 7.67-7.50 (m, 7H); \text{C} NMR (126 MHz, CDCl}_3 \delta 187.57, 140.16, 136.33, 135.96, 135.91, 135.52, 134.58, 133.28, 132.16, 131.43, 129.15, 129.05, 127.78; HRMS calcd. for: C15H11O3NaSCl [M+Na]+ = 329.0015, found 329.0021; IR: 3049, 1685, 1592, 1323, 1093, 853 cm\(^{-1}\).\)

\((E)-3-((3\text{-chlorophenyl})sulfonyl)-1\text{-phenylprop-2-en-1-one (3an)}\)

The reaction was conducted with 1-phenylprop-2-yn-1-one (1a, 26.0 mg, 0.2 mmol), sodium 3-chlorobenzenesulfinate (2n, 99.3 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol).
The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give \(3\text{an}\) as a viscous liquid; yield 81\%, E:Z = 97:03.

\(^1\)H NMR (500 MHz, CDCl\(_3\)) \(\delta\) 7.99-7.93 (m, 4H), 7.85 (d, \(J = 7.9\) Hz, 1H), 7.66 (t, \(J = 8.0\) Hz, 2H), 7.56-7.52 (m, 3H), 7.35 (d, \(J = 14.9\) Hz, 1H); \(^{13}\)C NMR (126 MHz, CDCl\(_3\)) \(\delta\) 187.40, 141.35, 140.51, 135.91, 134.59, 134.50, 134.00, 130.99, 129.14, 129.02, 128.29, 126.41; HRMS calcd. for: \(\text{C}_{15}\text{H}_{11}\text{O}_3\text{NaSCl} [\text{M+Na}]^+ = \text{329.0015}\), found 329.0026; IR: 3034, 1669, 1579, 1324, 1154, 797.

\((E)-3\)-(naphthalen-2-ylsulfonyl)-1-phenylprop-2-en-1-one (3ao)

\[
\text{The reaction was conducted with 1-phenylprop-2-yn-1-one (1a, 26.0 mg, 0.2 mmol), sodium naphthalene-2-sulfinate (2o, 107.0 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3ao as yellow solid; yield 87\%, E:Z = 95:05. m.p.: 120-127 °C; } \(^1\)H NMR (500 MHz, CDCl\(_3\)) \(\delta\) 8.57 (s, 1H), 8.03-7.97 (m, 5H), 7.94 (d, \(J = 8.1\) Hz, 1H), 7.88 (dd, \(J = 8.7, 1.7\) Hz, 1H), 7.70 (dd, \(J = 11.1, 4.0\) Hz, 1H), 7.65 (t, \(J = 7.4\) Hz, 2H), 7.53 (t, \(J = 7.8\) Hz, 2H), 7.43 (d, \(J = 14.9\) Hz, 1H); \(^{13}\)C NMR (126 MHz, CDCl\(_3\)) \(\delta\) 187.71, 142.05, 136.03, 135.58, 135.39, 134.50, 133.14, 132.31, 130.44, 130.08, 129.78, 129.56, 129.11, 129.01, 128.09, 127.98, 122.56; HRMS calcd. for: \(\text{C}_{16}\text{H}_{11}\text{O}_4\text{NaSF}_3 [\text{M+Na}]^+ = 379.0228\), found 379.0223; IR: 3047, 1675, 1446, 1316, 1148, 767 cm\(^{-1}\).
\]

\((E)-3\)-(cyclopropylsulfonyl)-1-phenylprop-2-en-1-one (3ap)

\[
\text{The reaction was conducted with 1-phenylprop-2-yn-1-one (1a, 26.0 mg, 0.2 mmol), sodium cyclopropanesulfinate (2p, 64.0 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol).}
\]
The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 3:1) to give \(3\text{ap}\) as white solid; yield 85%, E:Z = 94:06. m.p.: 64-72 °C; \(^1\)H NMR (500 MHz, CDCl\(_3\)) \(\delta\) 8.01 (d, \(J = 7.4\) Hz, 2H), 7.86 (d, \(J = 15.0\) Hz, 1H), 7.66 (t, \(J = 7.3\) Hz, 1H), 7.54 (t, \(J = 7.6\) Hz, 2H), 7.42 (d, \(J = 15.0\) Hz, 1H), 2.49-2.46 (m, 1H), 1.37-1.34 (m, 2H), 1.16-1.15 (m, 2H); \(^{13}\)C NMR (126 MHz, CDCl\(_3\)) \(\delta\) 185.91, 138.42, 134.15, 132.62, 132.35, 127.23, 127.13, 28.71, 3.78; HRMS calcd. for: C\(_{12}\)H\(_{13}\)O\(_3\)S [M+H] \(^+\) = 237.0585, found 237.0589; IR: 3051, 2918, 1683, 1592, 1321, 1093 cm\(^{-1}\).

(E)-7,7-dimethyl-1-(((3-oxo-3-phenylprop-1-en-1-yl)sulfonyl)methyl)bicyclo[2.2.1]heptan-2-one (3aq)

The reaction was conducted with 1-phenylprop-2-yn-1-one (\(1\text{a}\), 26.0 mg, 0.2 mmol), sodium (7,7-dimethyl-2-oxobicyclo[2.2.1]heptan-1-yl)methanesulfinate (\(2\text{q}\), 119.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 3aq as yellow solid; yield 75%, E:Z = 70:30. m.p.: 42-52 °C; \(^1\)H NMR (500 MHz, CDCl\(_3\)) \(\delta\) 8.01 (d, \(J = 7.6\) Hz, 2H), 7.81 (d, \(J = 15.0\) Hz, 1H), 7.65 (t, \(J = 6.9\) Hz, 1H), 7.58 (d, \(J = 15.0\) Hz, 1H), 7.53 (t, \(J = 7.3\) Hz, 1H), 3.53 (d, \(J = 14.9\) Hz, 1H), 2.99 (d, \(J = 14.9\) Hz, 1H), 2.42 (dd, \(J = 31.3, 16.7\) Hz, 1H), 2.15 (s, 1H), 1.94 (d, \(J = 18.4\) Hz, 1H), 1.09 (s, 2H), 0.89 (s, 2H); \(^{13}\)C NMR (126 MHz, CDCl\(_3\)) \(\delta\) 214.57, 187.96, 142.01, 136.09, 134.31, 133.85, 129.04, 58.86, 52.44, 48.65, 42.56, 42.52, 27.10, 25.14, 19.74, 19.67; HRMS calcd. for: C\(_{19}\)H\(_{22}\)O\(_4\)NaS [M+Na] \(^+\) = 369.1136, found 369.1139; IR: 3055, 2960, 1744, 1680, 1423, 1130 cm\(^{-1}\).

1-phenyl-3-(phenylsulfonyl)propan-1-one (5aa, CAS: 65885-28-1)
The reaction was conducted with 1-phenylprop-2-en-1-one (4a, 26.4 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 5aa as white solid; yield 84%.

m.p.: 100-104 °C; \( ^1H \) NMR (500 MHz, CDCl\(_3\)) \( \delta \) 7.99-7.95 (m, 2H), 7.93-7.92 (m, 2H), 7.68 (dd, \( J = 10.6, 4.3 \) Hz, 1H), 7.61-7.58 (m, 3H), 7.48 (t, \( J = 7.7 \) Hz, 2H), 3.59-3.56 (m, 2H), 3.53-3.49 (m, 2H); \( ^{13}C \) NMR (126 MHz, CDCl\(_3\)) \( \delta \) 195.46, 139.07, 135.81, 133.98, 133.84, 129.46, 128.83, 128.09, 128.02, 51.05, 31.39 cm\(^{-1}\).

1-(4-methoxyphenyl)-3-(phenylsulfonyl)propan-1-one (5ba)

The reaction was conducted with 1-(4-methoxyphenyl)prop-2-en-1-one (4b, 32.4 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 3:1) to give 5ba as white solid; yield 98%.

m.p.: 104-108 °C; \( ^1H \) NMR (500 MHz, CDCl\(_3\)) \( \delta \) 7.95 (d, \( J = 7.4 \) Hz, 2H), 7.90 (d, \( J = 7.3 \) Hz, 2H), 7.67 (t, \( J = 7.2 \) Hz, 1H), 7.58 (t, \( J = 7.1 \) Hz, 2H), 6.93 (d, \( J = 7.3 \) Hz, 2H), 3.87 (s, 3H), 3.57-3.54 (m, 2H), 3.46-3.43 (m, 2H); \( ^{13}C \) NMR (126 MHz, CDCl\(_3\)) \( \delta \) 193.88, 164.01, 139.08, 133.95, 130.42, 129.44, 128.87, 128.01, 113.96, 55.57, 51.17, 30.95; \( ^{13}C \) NMR (126 MHz, CDCl\(_3\)) \( \delta \) 193.88, 164.01, 139.08, 133.95, 130.42, 129.44, 128.87, 128.01, 113.96, 55.57, 51.17, 30.95; IR: 3434, 3017, 1678, 1602, 1254, 1110 cm\(^{-1}\).

1-([1,1'-biphenyl]-4-yl)-3-(phenylsulfonyl)propan-1-one (5ca, Cas: 1375496-17-5)

The reaction was conducted with 1-([1,1'-biphenyl]-4-yl)prop-2-en-1-one (4c, 41.7 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol).
The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 5ca as white solid; yield 88%.

m.p.: 170-174 °C; ¹H NMR (500 MHz, CDCl₃) δ 7.92-7.89 (m, 3H), 7.62-7.58 (m, 3H), 7.55-7.50 (m, 3H), 7.40 (t, J = 7.4 Hz, 2H), 7.34 (d, J = 7.3 Hz, 1H), 3.51-3.45 (m, 4H); ¹³C NMR (126 MHz, CDCl₃) δ 193.99, 145.45, 138.54, 138.07, 133.45, 132.94, 128.43, 127.99, 127.66, 127.42, 126.99, 126.38, 126.25, 50.05, 30.36; IR: 2991, 1681, 1604, 1262, 1143, 802 cm⁻¹.

1-(4-fluorophenyl)-3-(phenylsulfonyl)propan-1-one (5da)⁷

The reaction was conducted with 1-(4-fluorophenyl)prop-2-en-1-one (4d, 30.0 mg, 0.2 mmol), sodium benzenesulinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 5da as white solid; yield 97%.

m.p.: 132-138 °C; ¹H NMR (500 MHz, CDCl₃) δ 7.97-7.95 (m, 4H), 7.68 (t, J = 7.4 Hz, 1H), 7.59 (t, J = 7.6 Hz, 2H), 7.14 (t, J = 8.5 Hz, 2H), 3.56 (d, J = 7.3 Hz, 2H), 3.48 (d, J = 7.2 Hz, 2H); ¹³C NMR (126 MHz, CDCl₃) δ 193.89, 166.11 (d, J = 256.3 Hz), 139.02, 134.02, 132.27 (d, J = 2.8 Hz), 130.81 (d, J = 9.3 Hz), 129.48, 128.00, 116.09, 115.91, 50.97, 31.27; ¹⁹F NMR (471 MHz, CDCl₃) δ -103.59; IR: 2926, 1680, 1600, 1306, 1152, 843 cm⁻¹.

1-(4-chlorophenyl)-3-(phenylsulfonyl)propan-1-one (5ea)⁷

The reaction was conducted with 1-(4-chlorophenyl)prop-2-en-1-one (4e, 33.3 mg, 0.2 mmol), sodium benzenesulinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 5ea as white solid; yield 87%.
m.p.: 144-154 °C; \( ^1 \)H NMR (500 MHz, CDCl\(_3\)) \( \delta 7.95 \) (d, \( J = 7.5 \) Hz, 2H), 7.87 (d, \( J = 8.3 \) Hz, 2H), 7.68 (t, \( J = 7.1 \) Hz, 1H), 7.59 (t, \( J = 7.5 \) Hz, 2H), 7.45 (d, \( J = 8.2 \) Hz, 2H), 3.57-3.55 (m, 2H), 3.49-3.46 (m, 2H); \( ^{13} \)C NMR (126 MHz, CDCl\(_3\)) \( \delta 194.31, 140.37, 138.99, 134.10, 134.05, 131.55, 129.50, 129.18, 128.00, 50.92, 31.34; IR: 2926, 1683, 1590, 1306, 1151, 744 cm\(^{-1}\).

4-(3-(phenylsulfonyl)propanoyl)benzonitrile (5fa)

The reaction was conducted with 4-acryloylbenzonitrile (4f, 31.4 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 2:1) to give 5fa as white solid; yield 95%.

m.p.: 140-144 °C; \( ^1 \)H NMR (500 MHz, CDCl\(_3\)) \( \delta 7.95 \) (d, \( J = 8.3 \) Hz, 2H), 7.87 (d, \( J = 7.8 \) Hz, 2H), 7.71 (d, \( J = 8.2 \) Hz, 2H), 7.62 (t, \( J = 7.4 \) Hz, 1H), 7.52 (t, \( J = 7.7 \) Hz, 2H), 3.49 (d, \( J = 6.5 \) Hz, 2H), 3.45 (d, \( J = 7.0 \) Hz, 2H); \( ^{13} \)C NMR (126 MHz, CDCl\(_3\)) \( \delta 193.32, 137.89, 137.65, 133.12, 131.68, 128.52, 127.51, 126.95, 116.67, 116.03, 49.70, 30.69; IR: 2962, 2235, 1691, 1298, 1152, 845 cm\(^{-1}\).

1-(phenylsulfonyloctan-3-one (5ga, CAS: 82972-50-7)

The reaction was conducted with oct-1-en-3-one (4g, 25.2 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 5ga as white solid; yield 95%.

m.p.: 34-37 °C; \( ^1 \)H NMR (500 MHz, CDCl\(_3\)) \( \delta 7.91 \) (d, \( J = 7.4 \) Hz, 2H), 7.67 (t, \( J = 7.4 \) Hz, 1H), 7.58 (t, \( J = 7.7 \) Hz, 2H), 3.40-3.37 (m, 2H), 2.91-2.88 (m, 2H), 2.42 (t, \( J = 7.4 \) Hz, 1H), 1.56-1.51 (dm, 2H), 1.31-1.22 (m, 4H), 0.87 (t, \( J = 7.1 \) Hz, 3H); \( ^{13} \)C NMR (126 MHz, CDCl\(_3\)) \( \delta 206.25, 139.06, 133.89, 129.39, 127.96, 50.56, 42.81, 34.88, 31.22, 23.35, 22.34, 13.83; IR: 2991, 1681, 1604, 1262, 1143, 802 cm\(^{-1}\).
1-phenyl-3-tosylpropan-1-one (5ab, CAS: 52481-46-6)\(^2\)

![1-phenyl-3-tosylpropan-1-one](image)

The reaction was conducted with 1-phenylprop-2-en-1-one (4a, 26.0 mg, 0.2 mmol), sodium 4-methylbenzenesulfinate (2b, 89.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 5ab as yellow solid; yield 95%.

m.p.: 130-138 °C; \(^1\)H NMR (500 MHz, CDCl\(_3\)) \(\delta\) 7.92 \((d, J = 7.5\text{ Hz}, 2\text{H})\), 7.83 \((d, J = 8.1\text{ Hz}, 2\text{H})\), 7.59 \((t, J = 7.3\text{ Hz}, 1\text{H})\), 7.47 \((t, J = 7.6\text{ Hz}, 2\text{H})\), 7.37 \((d, J = 7.9\text{ Hz}, 2\text{H})\), 3.54 \((d, J = 7.4\text{ Hz}, 2\text{H})\), 3.49 \((d, J = 7.6\text{ Hz}, 2\text{H})\), 2.45 \((s, 3\text{H})\); \(^1\)C NMR (126 MHz, CDCl\(_3\)) \(\delta\) 195.58, 145.04, 136.01, 135.81, 133.82, 130.08, 128.82, 128.09, 128.05, 51.11, 31.53, 21.70; IR: 3052, 2939, 1681, 1316, 1147, 852 cm\(^{-1}\).

3-(cyclopropylsulfonyl)-1-phenylpropan-1-one (5ap)

![3-(cyclopropylsulfonyl)-1-phenylpropan-1-one](image)

The reaction was conducted with 1-phenylprop-2-en-1-one (4a, 26.0 mg, 0.2 mmol), sodium cyclopropanesulfinate (2p, 64.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 5ap as white solid; yield 95%.

m.p.: 97-100 °C; \(^1\)H NMR (500 MHz, CDCl\(_3\)) \(\delta\) 7.99 \((d, J = 7.9\text{ Hz}, 2\text{H})\), 7.61 \((t, J = 7.4\text{ Hz}, 1\text{H})\), 7.50 \((t, J = 7.6\text{ Hz}, 2\text{H})\), 3.60-3.52 \((m, 4\text{H})\), 2.52-2.43 \((m, 1\text{H})\), 1.29-2.06 \((m, 2\text{H})\), 1.09-1.05 \((m, 2\text{H})\); \(^1\)C NMR (126 MHz, CDCl\(_3\)) \(\delta\) 195.83, 135.86, 133.85, 128.86, 128.13, 48.43, 31.02, 29.98, 4.89; HRMS calcd. for: C\(_{12}\)H\(_{14}\)O\(_3\)NaS [M+Na] \(^+\) = 261.0561, found 261.0562; IR: 3052, 2939, 1681, 1676, 1597, 1278, 1117 cm\(^{-1}\).

1-(4-chlorophenyl)-4,4,4-trifluoro-3-(phenylsulfonyl)butan-1-one (5ha)
The reaction was conducted with (E)-1-(4-chlorophenyl)-4,4,4-trifluorobut-2-en-1-one (4h, 46.9 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 5ga as white solid; yield 60%.

m.p.: 123-126 °C; \(^1\)H NMR (500 MHz, CDCl\(_3\)) \(\delta\) 7.97 (dd, \(J = 16.6, 8.1\) Hz, 4H), 7.72 (t, \(J = 7.4\) Hz, 1H), 7.61 (t, \(J = 7.8\) Hz, 2H), 7.49 (d, \(J = 8.5\) Hz, 2H), 4.94-4.91 (m, 1H), 4.04 (dd, \(J = 18.4, 7.0\) Hz, 1H), 3.34 (dd, \(J = 18.4, 4.1\) Hz, 1H); \(^13\)C NMR (126 MHz, CDCl\(_3\)) \(\delta\) 191.81, 140.76, 138.36, 134.75, 133.68, 129.79, 129.49, 129.29, 128.92, 123.18 (q, \(J = 280.2\) Hz), 62.09 (q, \(J = 28.7\) Hz), 32.55; \(^19\)F NMR (471 MHz, CDCl\(_3\)) \(\delta\) -65.19; HRMS calcd. for: C\(_{16}\)H\(_{12}\)O\(_3\)NaSClF\(_3\) [M+Na\(^+\)] = 399.0045, found 399.0044; IR: 2950, 1695, 1589, 1324, 1148, 843 cm\(^{-1}\)

1,3-diphenyl-3-(phenylsulfonyl)propan-1-one (5ia, CAS: 300376-97-0)

The reaction was conducted with (E)-chalcone (4i, 41.7 mg, 0.2 mmol), sodium benzenesulfinate (2a, 82.1 mg, 0.5 mmol) and 4-chlorobenzoic acid (62.6 mg, 0.4 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 5ia as white solid; yield 61%.

m.p.: 154-158 °C; \(^1\)H NMR (500 MHz, CDCl\(_3\)) \(\delta\) 7.88 (dd, \(J = 23.7, 11.2\) Hz, 1H), 7.74 (d, \(J = 8.5\) Hz, 1H), 7.66 (d, \(J = 8.5\) Hz, 1H), 7.58 (t, \(J = 7.4\) Hz, 1H), 7.46 (t, \(J = 7.7\) Hz, 1H), 7.25 (d, \(J = 15.0\) Hz, 1H); \(^13\)C NMR (126 MHz, CDCl\(_3\)) \(\delta\) 186.43, 140.51, 136.73, 134.91, 133.53, 132.62, 132.00, 128.88, 128.75, 128.10, 127.96; IR: 3059, 1685, 1592, 1306, 1094, 762 cm\(^{-1}\)

1,3-diphenyl-3-tosylpropan-1-one (5ja)
The reaction was conducted with (E)-1-phenyl-3-(p-tolyl)prop-2-en-1-one (4j, 22.3 mg, 0.1 mmol), sodium benzenesulfinylate (2a, 41.0 mg, 0.25 mmol) and 4-chlorobenzoic acid (31.3 mg, 0.2 mmol). The residue was purified by column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) to give 5ja as white solid; yield 57%.

m.p.: 160-164 °C; ¹H NMR (500 MHz, CDCl₃) δ 7.93 (d, J = 7.7 Hz, 2H), 7.56 (dd, J = 13.5, 7.0 Hz, 4H), 7.45 (t, J = 7.7 Hz, 2H), 7.39 (t, J = 7.7 Hz, 2H), 7.07 (d, J = 8.0 Hz, 2H), 7.00 (d, J = 7.9 Hz, 2H), 4.91 (dd, J = 9.7, 3.4 Hz, 1H), 4.09 (dd, J = 17.8, 3.5 Hz, 1H), 3.91 (dd, J = 17.8, 9.8 Hz, 1H), 2.27 (s, 2H), 2.27 (s, 3H); ¹³C NMR (126 MHz, CDCl₃) δ 194.94, 138.75, 137.08, 136.19, 133.67, 133.66, 129.73, 129.62, 129.34, 129.21, 129.06, 128.74, 128.15, 66.22, 36.97, 21.17.

Ethyl 5-benzoyl-4-(phenylsulfonyl)cyclopent-1-ene-1-carboxylate (6aa)

m.p.: 104-117 °C; ¹H NMR (500 MHz, CDCl₃) δ 8.04 (d, J = 8.4 Hz, 1H), 7.96 (d, J = 7.7 Hz, 1H), 7.83 (d, J = 7.7 Hz, 1H), 7.58-7.52 (m, 2H), 7.46-7.41 (m, 5H), 6.87 (d, J = 1.6 Hz, 1H), 5.35 (s, 1H), 4.16-4.12 (m, 1H), 4.02 (q, J = 7.1 Hz, 2H), 3.13 (d, J = 19.3 Hz, 1H), 2.98 (dd, J = 19.3, 9.0 Hz, 1H), 1.02 (t, J = 7.1 Hz, 3H); ¹³C NMR (126 MHz, CDCl₃) δ 199.28, 162.78, 142.91, 137.12, 135.99, 135.64, 134.16, 133.62, 129.38, 129.09, 128.57, 128.53, 66.91, 60.91, 51.02, 34.15, 13.81; HRMS (ESI) m/z calcd. for C₂₁H₂₀NaO₅S[M+Na]⁺ = 407.0929, found 407.0918; IR: 2964, 1679, 1644, 1146, 747 cm⁻¹

Ethyl 5-[[1,1'-biphenyl]-4-carbonyl]-4-(phenylsulfonyl)cyclopent-1-ene-1-carboxylate (6ea)
m.p.: 164-171 °C; ¹H NMR (500 MHz, CDCl₃) δ 8.04 (d, J = 8.3 Hz, 2H), 7.85 (d, J = 7.8 Hz, 2H), 7.65 (t, J = 7.7 Hz, 4H), 7.53-7.48 (m, 3H), 7.46-7.42 (m, 3H), 6.88 (d, J = 1.7 Hz, 1H), 5.39 (d, J = 2.4 Hz, 1H), 4.20-4.15 (m, 1H), 4.07-4.02 (m, 2H), 3.16-3.12 (m, 1H), 3.03-2.97 (m, 1H), 1.06 (t, J = 7.1 Hz, 2H); ¹³C NMR (126 MHz, CDCl₃) δ 198.88, 162.86, 146.23, 142.87, 139.80, 137.19, 135.70, 134.70, 134.15, 129.72, 129.41, 129.04, 128.59, 128.39, 127.30, 127.16, 66.96, 60.96, 51.05, 34.20, 13.89; HRMS (ESI) m/z calcd. for C₂₇H₂₄O₅S [M+H]⁺ = 461.1423, found 461.1445; IR: 2972, 1710, 1649, 1279, 1140, 760 cm⁻¹

Ethyl 5-(4-fluorobenzoyl)-4-(phenylsulfonyl)cyclopent-1-ene-1-carboxylate (6fa)

m.p.: 115-124 °C; ¹H NMR (500 MHz, CDCl₃) δ 8.03 (dd, J = 8.2, 5.6 Hz, 2H), 7.83 (d, J = 7.7 Hz, 2H), 7.57 (t, J = 7.4 Hz, 1H), 7.45 (t, J = 7.7 Hz, 2H), 7.11 (t, J = 8.5 Hz, 2H), 6.88 (s, 1H), 5.32-5.30 (m, 1H), 4.16-4.12 (m, 1H), 4.06-4.01 (m, 2H), 3.11 (d, J = 19.3 Hz, 1H), 2.97 (dd, J = 19.3, 9.0 Hz, 1H), 1.06 (t, J = 7.1 Hz, 3H); ¹³C NMR (126 MHz, CDCl₃) δ 197.77, 163.90 (d, J = 288.8 Hz), 167.08, 142.93, 137.06, 135.46, 134.20, 132.44 (d, J = 2.7 Hz), 131.88, 131.81, 129.40, 128.52, 115.66 (d, J = 22.0 Hz), 66.83, 60.95, 50.86, 34.21, 13.85; ¹⁹F NMR (471 MHz, CDCl₃) δ -104.09; HRMS (ESI) m/z calcd. for C₂₁H₁₉FNaO₅S [M+Na]⁺ = 425.0835, found 425.0824; IR: 2965, 1715, 1597, 1456, 1093, 955, 759 cm⁻¹.

3-phenyl-1H-pyrazole (6b, CAS: 2458-26-6)¹¹

m.p.: 38-47 °C; ¹H NMR (500 MHz, CDCl₃) δ 10.54 (s, 1H), 7.75 (d, J = 7.4 Hz, 2H), 7.60 (s, 1H), 7.44-7.38 (m, 2H), 7.32 (t, J = 7.3 Hz, 1H), 6.61 (s, 1H); ¹³C NMR (126 MHz, CDCl₃) δ 132.03, 131.44, 128.82, 128.69, 128.12, 125.88, 102.76; IR: 2924, 1594, 1456, 1093, 955, 759 cm⁻¹.
2-cyclopropyl-4-(4-fluorophenyl)-3-(1H-pyrazol-3-yl)quinoline (6c)

\[ \text{m.p.: 93-112 } \degree \text{C; } \text{\textsuperscript{1}H NMR (500 MHz, CDCl}_3\text{)} \delta 7.98 (d, J = 8.4 \text{ Hz, 1H}), 7.63 (dd, J = 11.2, 4.0 \text{ Hz, 1H}), 7.41 (d, J = 8.3 \text{ Hz, 1H}), 7.37-7.32 (m, 2H), 7.08-7.05 (m, 2H), 6.98-6.94 (m, 2H), 6.07 (s, 1H), 2.04-2.01 (m, 1H), 1.29 (d, J = 2.2 \text{ Hz, 3H}), 0.87 (dd, J = 4.8, 3.1 \text{ Hz, 2H}); \text{\textsuperscript{13}C NMR (126 MHz, CDCl}_3\text{)} \delta 163.07, 161.67, 161.10, 147.32 (d, J = 115.8 \text{ Hz}, 133.37, 132.60 (d, J = 3.2 \text{ Hz), 131.37 (d, J = 7.9 } \degree \text{ Hz), 129.52, 128.97, 126.25, 125.58, 125.50, 124.77, 114.99, 114.82, 107.79, 15.53, 10.98; } \text{\textsuperscript{19}F NMR (471 MHz, CDCl}_3\text{)} \delta -114.1; \text{HRMS calcd. for: C}_{21}\text{H}_{17}\text{N}_3\text{F [M+H]}^+ = 330.1407, \text{found 330.1414; IR: 2929, 1605, 1513, 1132, 922, 841 cm}^{-1}. \]

5. X-ray Crystal Structure for 6fa

![X-ray Crystal Structure](image_url)
6. Reference

7. $^1\text{H}$, $^{13}\text{C}$, $^{19}\text{F}$ NMR spectra of compounds.
$\text{3na}$
52
5da