Supporting Information

Eosin Y-Sensitized Photocatalytic Reaction of Tertiary Aliphatic Amines with Arenesulfonyl Chlorides under Visible Light Irradiation

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**General information**

All available reagents were distilled prior to use. Flash column chromatography was carried out over silica gel (200-300 mesh). The obtained products were characterized by $^1$H NMR and $^{13}$C NMR spectra, which were recorded on a Bruker Advance 400 spectrometer in CDCl$_3$ at 400 MHz and 100 MHz, respectively. All the coupling constants ($J$) are reported in Hz. TLC was performed using Silica Gel GF254 plates and was visualized by fluorescence quenching at 254 nm. The high resolution mass spectra (HRMS) were measured on a Bruker Daltonics micrOTOF II spectrometer by ESI.

**General procedure for the synthesis of vinyl sulfones**

To a 10 mL round bottom flask equipped with magnetic stirring bar was added 4-toluenesulfonyl chloride 1a (0.2 mmol), triethylamine 2a (1 mmol), Eosin Y (3 mol%), K$_2$HPO$_4$ (1.5 eq) and C$_2$H$_5$OH/CH$_3$COCH$_3$ (1/2, 6 mL). The solution was irradiated with 3 W Blue LEDs at -5-5℃ in an air atmosphere. After the completion of the reaction (indicated by TLC), the solvent was removed under reduced pressure. The crude product was purified by column chromatography on silica gel with petroleum ether/ethyl acetate (5:1) to afford the desired pure product 3a.

**General procedure for the synthesis of sulfonamides**

To a 10 mL round bottom flask equipped with magnetic stirring bar was added 4-toluenesulfonyl chloride 1a (0.2 mmol), triethylamine 2a (1 mmol), Eosin Y (3 mol%), K$_2$HPO$_4$ (1.5 eq) and CH$_3$CN/H$_2$O (1/1, 6 mL). The solution was irradiated with 12 W Blue LEDs at room temperature in O$_2$ atmosphere. After the completion of the reaction (indicated by TLC), the solvent was removed under reduced pressure.
The crude product was purified by column chromatography on silica gel with petroleum ether/ethyl acetate (5:1) to afford the desired pure product 4a.

**Emission Quenching Experiments**

Emission intensities were recorded using a Steady State emission spectra were recorded on an Edinburgh Instrument FP920 Phosphorescence Lifetime Spectrometer equipped with a 5 watt microsecond pulsed xenon flash lamp and a 450 watt steady state xenon lamp and a red sensitive photomultiplier in peltier housing, (Hamamatsu R928P), spectrophotometer. All the EY solutions were excited at 400 nm and the emission intensity was collected at 555 nm. In a typical experiment, an appropriate amount of 0.025 M solution of EY in C₂H₅OH/CH₃COCH₃ (1:2) was added to a solution of appropriate amount of quencher in a quartz cuvette. After standing in the air for 5 minutes, the emission spectrum of the sample was collected.

Stern-Volmer Plots
Characterization of products

(E)-N, N-diethyl-2-tosylethenamine (3a)
Brown oil; $^1$H NMR (400 MHz, CDCl$_3$): δ 7.75 (d, J = 8.2 Hz, 2H), 7.31 (d, J = 12.7 Hz, 1H), 7.27 (d, J = 8.0 Hz, 2H), 4.91 (d, J = 12.7 Hz, 1H), 3.18 (broad doublet, 4H), 2.41 (s, 3H), 1.17 (bs, 6H).
$^{13}$C NMR (100 MHz, CDCl$_3$) δ 148.5, 142.3, 141.8, 128.5, 125.9, 91.4, 49.8 (bs), 42.4 (bs), 21.2, 14.5 (bs) 11.0 (bs).
HRMS (ESI): calcd for C$_{13}$H$_{19}$O$_2$NS + Na =276.1020, found: 276.1029.

(E)-N,N-Diethyl-2-(phenylsulfonyl)ethenamine (3b)
White solid; mp 45-46˚C; $^1$H NMR (400 MHz, CDCl$_3$) δ 7.92-7.86 (m, 2H), 7.55-7.47 (m, 3H), 7.35 (d, J = 12.7 Hz, 1H), 4.94 (d, J = 12.7 Hz, 1H), 3.22 (broad doublet, 4H), 1.19 (broad doublet, 6H).
$^{13}$C NMR (100 MHz, CDCl$_3$) δ 148.9, 145.2, 131.3, 128.6, 125.8, 91.0, 49.8 (bs), 42.5 (bs), 14.5 (bs), 10.9 (bs).
HRMS (ESI): calcd for C$_{12}$H$_{17}$O$_2$NS + Na =257.1324, found: 257.1318.

(E)-N,N-diethyl-2-(4-methoxyphenylsulfonyl)ethenamine (3c)
Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) δ 7.81 (d, J = 8.9 Hz, 2H), 6.97 (d, J = 8.9 Hz, 2H), 4.92 (d, J = 12.7 Hz, 1H), 3.88 (s, 3H), 3.20 (broad doublet, 4H), 1.18 (bs, 6H).
$^{13}$C NMR (100 MHz, CDCl$_3$) δ 161.8, 148.2, 137.1, 127.9, 113.7, 91.8, 55.3, 49.7 (bs), 42.1 (bs), 14.4 (bs), 11.0 (bs).
HRMS (ESI): calcd for C$_{13}$H$_{19}$O$_3$NS + Na =292.1005, found: 292.0978.

(E)-2-(4-(tert-butyl)phenylsulfonyl)-N,N-diethylethenamine (3d)
Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) δ 7.80 (d, J = 8.5 Hz, 2H), 7.50 (d, J = 8.5 Hz, 2H), 7.34 (d, J = 12.7 Hz, 1H), 4.94 (d, J = 12.7 Hz, 1H), 3.21 (broad doublet, 4H), 1.36 (s, 3H), 1.19 (broad doublet, 6H).
$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 154.9, 148.7, 142.2, 125.8, 125.7, 91.5, 49.9 (bs), 42.5 (bs), 34.9, 31.1, 14.1 (bs), 11.1 (bs).

HRMS (ESI): calcd for C$_{16}$H$_{25}$O$_2$NS + Na $=$ 313.1944, found: 313.1933.

($E$)-$N,N$-diethyl-2-(4-methoxyphenylsulfonyl)ethenamine (3e)
Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.92-7.85 (m, 2H), 7.34 (d, $J$ = 12.7 Hz, 1H), 7.17 (t, $J$ = 8.6 Hz, 2H), 4.91 (d, $J$ = 12.6 Hz, 1H), 3.23 (broad doublet, 4H), 1.19 (bs, 6H).
$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 165.5, 163.0, 149.01, 141.43, 128.6, 128.5, 115.8, 115.6, 91.0, 50.0 (bs), 42.6 (bs), 14.1 (bs), 11.0 (bs).

HRMS (ESI): calcd for C$_{12}$H$_{16}$FO$_2$NS + Na $=$ 280.0778, found: 280.0750.

($E$)-2-(4-chlorophenylsulfonyl)-$N,N$-diethylethenamine (3f)
Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.81 (d, $J$ = 8.5 Hz, 2H), 7.50-7.39 (m, 2H), 7.33 (d, $J$ = 12.7 Hz, 1H), 4.90 (d, $J$ = 12.6 Hz, 1H), 3.21 (broad doublet, 4H), 1.29-1.09 (m, 6H).
$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 149.2, 143.8, 137.6, 128.9, 127.5, 90.7, 50.0 (bs), 42.6 (bs), 14.1 (bs), 11.0 (bs).

HRMS (ESI): calcd for C$_{12}$H$_{16}$ClO$_2$NS + Na $=$ 296.0482, found: 296.0467.

($E$)-2-((4-Bromophenyl)sulfonyl)-$N,N$-diethylethenamine (3g)
Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.74 (d, $J$ = 8.5 Hz, 2H), 7.62 (d, $J$ = 8.4 Hz, 2H), 7.37-7.28 (m, 1H), 4.89 (d, $J$ = 12.6 Hz, 1H), 3.21 (broad doublet, 4H), 1.18 (broad doublet, 6H).
$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 149.2, 144.4, 131.9, 127.7, 126.0, 90.7, 50.1 (bs), 42.6 (bs), 14.6 (bs), 11.0 (bs).

HRMS (ESI): calcd for C$_{12}$H$_{16}$BrO$_2$NS + Na $=$ 339.9977, found: 339.9954.

($E$)-$N,N$-diethyl-2-((4-nitrophenyl)sulfonyl)ethenamine (3h)
Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 8.34 (d, $J$ = 8.5 Hz, 2H), 8.05 (d, $J$ = 8.8 Hz, 2H), 7.38 (d, $J$ = 12.7 Hz, 1H), 4.92 (d, $J$ = 12.6 Hz, 1H), 3.25 (broad doublet, 4H), 1.26 (t, $J$ = 7.2 Hz, 3H), 1.16 (t, $J$ = 7.3 Hz, 3H).
\[ ^{13}\text{C NMR (100 MHz, CDCl}_3 \text{)} \delta 151.1, 150.1, 149.2, 127.2, 124.1, 89.6, 50.3 \text{(bs), 42.8 (bs), 14.6 (bs), 11.0 (bs).} \]

HRMS (ESI): calcd for C\text{12H}_{16}\text{O}_4\text{N}_2\text{S} + \text{Na} = 307.0723, found: 307.0718.

\[ \begin{array}{c}
\text{CF}_3 - \text{O} \\
\text{N} \\
\end{array} \]

**(E)-N,N-diethyl-2-((4-(trifluoromethyl)phenyl)sulfonyl)ethenamine (3i)**

Brown oil; \(^1^\text{H NMR (400 MHz, CDCl}_3 \text{)} \delta 8.01 \text{ (d, J = 8.1 Hz, 2H), 7.76 (d, J = 8.2 Hz, 2H), 7.37 (d, J = 12.6 Hz, 1H), 4.92 (d, J = 12.7 Hz, 1H), 3.24 \text{ (broad doublet, 4H), 1.20 \text{ (broad doublet, 6H).} } \]

\[ ^{13}\text{C NMR (100 MHz, CDCl}_3 \text{)} \delta 149.7, 148.8, 133.1, 126.5, 125.9, 125.93, 125.8, 90.0, 50.1 \text{(bs), 42.7 (bs), 14.6 (bs), 11.0 (bs).} \]

HRMS (ESI): calcd for C\text{13H}_{16}\text{F}_3\text{O}_2\text{NS} + \text{Na} = 330.0746, found: 330.0743.

\[ \begin{array}{c}
\text{N} \\
\text{O} \\
\text{S} \\
\end{array} \]

**(E)-N,N-diethyl-2-tosylethenamine (3J)**

Brown oil; \(^1^\text{H NMR (400 MHz, CDCl}_3 \text{)} \delta 7.77 \text{ (d, J = 7.4 Hz, 2H), 7.43 (d, J = 12.7 Hz, 1H), 7.30 (d, J = 8.0 Hz, 2H), 5.00 (d, J = 12.7 Hz, 1H), 3.62 (s, 2H), 2.44 (s, 3H), 1.24 \text{ (broad doublet, 12H).} \]

\[ ^{13}\text{C NMR (100 MHz, CDCl}_3 \text{)} \delta 144.9, 142.6, 141.9, 129.4, 126.1, 91.6, 49.1 \text{(bs), 47.1 (bs), 23.4, 21.4 (bs), 19.2 (bs).} \]

HRMS (ESI): calcd for C\text{14H}_{20}\text{O}_2\text{NS} + \text{Na} = 304.1342, found: 304.1344.

\[ \begin{array}{c}
\text{N} \\
\text{O} \\
\text{S} \\
\end{array} \]

**(E)-N,N-diethyl-2-(phenylsulfonyl)ethenamine (3k)**

Brown oil; \(^1^\text{H NMR (400 MHz, CDCl}_3 \text{)} \delta 7.89 \text{ (d, J = 7.7 Hz, 2H), 7.51 (d, J = 7.1 Hz, 3H), 7.44 (d, J = 12.8 Hz, 1H), 5.01 (d, J = 12.8 Hz, 1H), 3.64 (s, 2H), 1.24 \text{ (broad doublet, 12H).} \]

\[ ^{13}\text{C NMR (100 MHz, CDCl}_3 \text{)} \delta 145.3, 145.1, 131.2, 128.6, 125.9, 91.1, 49.1 \text{(bs), 47.4 (bs), 23.3 (bs), 18.9 (bs).} \]

HRMS (ESI): calcd for C\text{14H}_{21}\text{O}_2\text{NS} + \text{Na} = 290.1185, found: 290.1168.

\[ \begin{array}{c}
\text{N} \\
\text{O} \\
\text{S} \\
\end{array} \]

**(E)-N,N-dibutyl-2-tosylbut-1-en-1-amine (3l)**

Brown oil; \(^1^\text{H NMR (400 MHz, CDCl}_3 \text{)} \delta 7.73 \text{ (d, J = 8.3 Hz, 2H), 7.34 (s, 1H), 7.28 (d, J = 6.9 Hz, 2H), 3.20 (t, J = 7.6 Hz, 4H), 2.43 (s, 3H), 2.24 (q, J = 7.1 Hz, 2H),} \]
1.56 (m, 4H), 1.33 (m, 4H), 0.97 (t, J = 7.0 Hz, 9H).

$^{13}$C NMR (100 MHz, CDCl$_3$) δ 145.1, 141.9, 140.5, 129.1, 126.9, 103.9, 52.5, 31.1, 21.3, 19.6, 18.5, 15.2, 13.7.

HRMS (ESI): calcd for C$_{19}$H$_{31}$O$_2$NS + Na $=360.1968$, found: 360.1978.

![ethyl-5-tosyl-1,2,3,4-tetrahydropyridine (3m)](image1)

Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) δ 7.73 (d, J = 8.3 Hz, 2H), 7.34 (s, 1H), 7.29 (d, J = 7.9 Hz, 2H), 3.23 (q, J = 7.2 Hz, 2H), 3.11-3.05 (m, 2H), 2.43 (s, 3H), 2.19 (q, J = 6.2 Hz, 2H), 1.87 (m, 2H), 1.20 (t, J = 7.2 Hz, 3H).

$^{13}$C NMR (100 MHz, CDCl$_3$) δ 143.4, 142.1, 139.8, 129.3, 126.7, 99.6, 50.3, 44.7, 21.4, 21.0, 19.6, 13.8.

HRMS (ESI): calcd for C$_{14}$H$_{19}$O$_2$NS + Na $=288.1029$, found: 288.1017.

![ethyl-5-(phenylsulfonyl)-1,2,3,4-tetrahydropyridine (3n)](image2)

Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) δ 7.85 (d, J = 8.0, 1.7 Hz, 2H), 7.56-7.48 (m, 3H), 7.36 (s, 1H), 3.24 (q, J = 7.2 Hz, 2H), 3.13-3.05 (m, 2H), 2.20 (t, J = 6.2 Hz, 2H), 1.83 (p, J = 6.1 Hz, 2H), 1.21 (t, J = 7.2 Hz, 3H).

$^{13}$C NMR (100 MHz, CDCl$_3$) δ 143.7, 142.8, 131.5, 131.5, 128.6, 126.6, 99.2, 50.3, 44.7, 21.0, 19.6, 13.8.

$N,N$-Diethyl-4-methylbenzenesulfonylamide (4a)

White solid; mp 60–62 °C; $^1$H NMR (400 MHz, CDCl$_3$) δ 7.70 (d, J = 8.1 Hz, 2H), 7.30 (d, J = 8.0 Hz, 2H), 3.23 (q, J = 7.2 Hz, 4H), 2.43 (s, 3H), 1.13 (t, J = 7.1 Hz, 6H).

$^{13}$C NMR (100 MHz, CDCl$_3$) δ 142.8, 137.2, 129.4, 126.9, 41.9, 21.3, 14.0.

HRMS (ESI): calcd for C$_{11}$H$_{17}$O$_2$NS + Na $=250.0872$, found: 250.0898.

![N,N-Diethylbenzenesulfonylamide (4b)](image3)

Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) δ 7.85 (d, J = 6.9 Hz, 2H), 7.58 (d, J = 7.2 Hz, 1H), 7.57-7.50 (m, 2H), 3.28 (q, J = 7.2 Hz, 4H), 1.16 (t, J = 7.2 Hz, 6H).

$^{13}$C NMR (100 MHz, CDCl$_3$) δ 140.3, 132.1, 128.9, 126.9, 41.9, 14.0.

HRMS (ESI): calcd for C$_{10}$H$_{15}$O$_2$NS + Na $=236.0716$, found: 236.0718.
N,N-Diethyl-4-methoxybenzenesulfonamide (4c)
Brown oil; ¹H NMR (400 MHz, CDCl₃) δ 7.78 (d, J = 8.9 Hz, 2H), 7.00 (d, J = 8.9 Hz, 2H), 3.90 (s, 3H), 3.25 (q, J = 7.2 Hz, 4H), 1.16 (t, J = 7.2 Hz, 6H).
¹³C NMR (100 MHz, CDCl₃) δ 162.5, 132.1, 129.0, 114.0, 55.5, 41.9, 14.0.
HRMS (ESI): calcd for C₁₁H₁₇O₃NS + Na =266.0821, found: 266.0843.

4-(Tert-butyl)-N,N-diethylbenzenesulfonamide (4d)
Brown oil; ¹H NMR (400 MHz, CDCl₃) δ 7.76 (d, J = 8.6 Hz, 2H), 7.53 (d, J = 4.8 Hz, 2H), 3.27 (q, J = 7.1 Hz, 4H), 1.37 (s, 9H), 1.17 (t, J = 7.1 Hz, 6H).
¹³C NMR (100 MHz, CDCl₃) δ 155.7, 137.1, 126.7, 125.7, 41.9, 34.9, 30.9, 14.1.

N,N-Diethyl-4-fluorobenzenesulfonamide (4e)
Brown oil; ¹H NMR (400 MHz, CDCl₃) δ 7.89-7.83 (m, 2H), 7.21 (t, J = 8.6 Hz, 2H), 3.27 (q, J = 7.1 Hz, 4H), 1.16 (t, J = 7.2 Hz, 6H).
¹³C NMR (100 MHz, CDCl₃) δ 165.8, 163.7, 136.4, 136.3, 129.4, 129.3, 116.0, 115.8, 41.8, 13.9.

4-Chloro-N,N-diethylbenzenesulfonamide (4f)
Brown oil; ¹H NMR (400 MHz, CDCl₃) δ 7.78 (d, J = 8.6 Hz, 2H), 7.51 (d, J = 8.6 Hz, 2H), 3.27 (q, J = 7.2 Hz, 4H), 1.17 (t, J = 7.2 Hz, 6H).
¹³C NMR (100 MHz, CDCl₃) δ 138.9, 138.6, 129.2, 128.3, 42.0, 14.0.
HRMS (ESI): calcd for C₁₀H₁₄ClO₂NS + Na =270.0326, found: 270.0319.

4-Bromo-N,N-diethylbenzenesulfonamide (4g)
Brown oil; ¹H NMR (400 MHz, CDCl₃) δ 7.71 (d, J = 8.7 Hz, 2H), 7.66 (d, J = 8.7 Hz, 2H), 3.26 (q, J = 7.1 Hz, 4H), 1.16 (t, J = 7.2 Hz, 6H).
¹³C NMR (100 MHz, CDCl₃) δ 139.5, 132.3, 128.5, 127.1, 42.1, 14.1.
HRMS (ESI): calcd for C₁₀H₁₄BrO₂NS + Na =313.9824, found: 313.9824.
**N,N-Diethyl-4-nitrobenzenesulfonamide (4h)**
Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 8.39 (d, $J = 8.9$ Hz, 2H), 8.04 (d, $J = 8.8$ Hz, 2H), 3.34 (q, $J = 7.1$ Hz, 4H), 1.20 (t, $J = 7.1$ Hz, 6H).
$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 149.8, 146.5, 128.1, 124.3, 42.2, 14.1.
HRMS (ESI): calcd for C$_{10}$H$_{14}$O$_4$N$_2$S + Na = 281.0566, found: 281.0596.

**N-(4-(N,N-diethylsulfamoyl)phenyl)acetamide (4i)**
Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 8.21 (s, 1H), 7.75 (d, $J = 8.9$ Hz, 2H), 7.70 (d, $J = 8.9$ Hz, 2H), 3.24 (q, $J = 7.2$ Hz, 4H), 2.24 (s, 3H), 1.15 (t, $J = 7.2$ Hz, 6H).
$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 169.2, 169.0, 141.9, 141.8, 134.6, 134.6, 128.0, 128.0, 119.3, 42.0, 24.5, 14.0.
HRMS (ESI): calcd for C$_{12}$H$_{18}$O$_3$N$_2$S + Na = 293.0930, found: 293.0958.

**4-Methyl-N,N-dipropylbenzenesulfonamide (4j)**
Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.71 (d, $J = 8.1$ Hz, 2H), 7.31 (d, $J = 8.1$ Hz, 2H), 3.11-3.04 (m, 4H), 2.44 (s, 3H), 1.57 (q, $J = 7.6$ Hz, 4H), 0.89 (t, $J = 7.4$ Hz, 6H).
$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 142.7, 137.0, 129.4, 126.9, 49.9, 21.9, 21.3, 11.0.
HRMS (ESI): calcd for C$_{13}$H$_{21}$O$_2$NS + Na = 278.1185, found: 278.1215.

**4-Chloro-N,N-dipropylbenzenesulfonamide (4k)**
Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.78 (d, $J = 8.6$ Hz, 2H), 7.51 (d, $J = 8.6$ Hz, 2H), 3.15-3.08 (m, 4H), 1.59 (h, $J = 7.5$ Hz, 4H), 0.91 (t, $J = 7.4$ Hz, 6H).
$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 138.7, 138.6, 129.2, 128.4, 49.9, 21.9, 11.1.
HRMS (ESI): calcd for C$_{12}$H$_{18}$ClO$_2$NS + Na = 298.0639, found: 298.0647.

**N,N-dipropylbenzenesulfonamide (4l)**
Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.84 (d, $J = 6.9$ Hz, 2H), 7.58 (d, $J = 7.1$ Hz, 1H), 7.53 (t, $J = 7.4$ Hz, 2H), 3.16-3.07 (m, 4H), 1.58 (q, $J = 7.5$ Hz, 4H), 0.90 (t, $J = 7.4$ Hz, 6H).
$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 140.1, 132.1, 128.9, 49.9, 21.9, 11.1.
HRMS (ESI): calcd for C$_{12}$H$_{19}$O$_2$NS + Na = 264.1029, found: 264.1042.
**N,N-dibutyl-4-methylbenzenesulfonamide (4m)**
Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.71 (d, $J = 8.0$ Hz, 2H), 7.32 (d, $J = 8.2$ Hz, 2H), 3.18-3.06 (m, 4H), 2.45 (s, 3H), 1.53 (p, $J = 7.4$ Hz, 4H), 1.32 (q, $J = 7.5$ Hz, 4H), 0.93 (t, $J = 7.3$ Hz, 6H).
$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 142.8, 137.0, 129.4, 127.0, 47.9, 30.7, 21.4, 19.9, 13.6.
HRMS (ESI): calcd for C$_{15}$H$_{25}$O$_2$NS + Na = 306.1498, found: 306.1507.

**N,N-dibutylbenzenesulfonamide (4n)**
Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.84 (d, $J = 8.2$ Hz, 2H), 7.58 (d, $J = 8.7$ Hz, 1H), 7.57-7.50 (m, 2H), 3.19-3.11 (m, 4H), 1.53 (p, $J = 7.4$ Hz, 4H), 1.38-1.27 (m, 4H), 0.93 (t, $J = 7.3$ Hz, 6H).
$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 139.9, 132.0, 128.7, 126.8, 47.7, 30.5, 19.7, 13.5.
HRMS (ESI): calcd for C$_{14}$H$_{23}$O$_2$NS + Na = 292.1342, found: 292.1355.

**N,N-dibutyl-4-chlorobenzenesulfonamide (4o)**
Brown oil; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.78 (d, $J = 8.6$ Hz, 2H), 7.51 (d, $J = 8.5$ Hz, 2H), 3.18-3.11 (m, 4H), 1.54 (p, $J = 7.4$ Hz, 4H), 1.38-1.28 (m, 4H), 0.94 (t, $J = 7.4$ Hz, 6H).
$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 138.8, 138.7, 129.4, 128.6, 48.1, 30.8, 20.0, 13.8.
HRMS (ESI): calcd for C$_{14}$H$_{22}$ClO$_2$NS + Na = 326.0952, found: 326.0962.

**4-Tosylmorpholine (4p)**
White solid; mp 145-147 °C; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.68 (d, $J = 8.0$ Hz, 2H), 7.39 (d, $J = 7.9$ Hz, 2H), 3.78 (t, $J = 4.7$ Hz, 4H), 3.05-2.99 (m, 4H), 2.49 (s, 3H).
$^{13}$C NMR (100 MHz, CDCl$_3$)
HRMS (ESI): calcd for 2C$_{11}$H$_{15}$O$_3$NS + Na = 505.1437, found: 505.1409.

**N,N-Diethyl-4-methylbenzenesulfonamide (4q1)**
White solid; mp 60-62 °C; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.70 (d, $J = 8.1$ Hz, 2H),
7.30 (d, J = 8.0 Hz, 2H), 3.23 (q, J = 7.2 Hz, 4H), 2.43 (s, 3H), 1.13 (t, J = 7.1 Hz, 6H).

$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 142.8, 137.2, 129.4, 126.9, 41.9, 21.3, 14.0.

HRMS (ESI): calcd for C$_{11}$H$_{17}$O$_2$NS + Na = 250.0872, found: 250.0898.

$N$-ethyl-$N$,$4$-dimethylbenzenesulfonamide (4q2)
Brown oil, $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.66 (d, J = 8.0 Hz, 2H), 7.31 (d, J = 8.0 Hz, 2H), 3.08 (q, J = 7.2 Hz, 2H), 2.71 (s, 3H), 2.42 (s, 3H), 1.12 (t, J = 7.2 Hz, 3H).

$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 143.15, 134.71, 129.58, 127.37, 44.82, 33.94, 21.48, 13.05.

HRMS (ESI): calcd for C$_{10}$H$_{15}$O$_2$NS + Na = 236.0716, found: 236.0716.
$^1$H and $^{13}$C NMR spectra of products

**(E)-N, N-diethyl-2-tosylethenamine (3a)**

[Chemical structure diagram]

[Graph of NMR spectra]
(E)-N,N-Diethyl-2-(phenylsulfonyl)ethenamine (3b)
(E)-N,N-diethyl-2-(4-methoxyphenylsulfonyl)ethenamine (3c)
(E)-2-(4-(tert-butyl)phenylsulfonyl)-N,N-diethylethenamine (3d)
(E)-N,N-diethyl-2-(4-methoxyphenylsulfonyl)ethenamine (3e)
\textit{(E)}-2-(4-chlorophenylsulfonyl)-N,N-diethylethenamine (3f)
(E)-2-((4-Bromophenyl)sulfonyl)-N,N-diethylethenamine (3g)
(E)-N,N-diethyl-2-((4-nitrophenyl)sulfonyl)ethenamine (3h)
(E)-N,N-diethyl-2-((4-(trifluoromethyl)phenyl)sulfonyl)ethenamine (3i)
(E)-N, N-diehyd-2-tosylethenamine (3J)
(E)-N, N-diethyl-2-(phenylsulfonyl)ethenamine (3k)
(E)-N,N-dibutyl-2-tosylbut-1-en-1-amine (3l)
ethyl-5-tosyl-1,2,3,4-tetrahydropyridine (3m)
ethyl-5-(phenylsulfonyl)-1,2,3,4-tetrahydropyridine (3n)
N,N-Diethyl-4-methylbenzenesulfonamide (4a)
$N,N$-Diethylbenzenesulfonamide (4b)
$N,N$-Diethyl-4-methoxybenzenesulfonamide (4c)
4-(Tert-butyl)-N,N-diethylbenzenesulfonamide (4d)
$N,N$-Diethyl-4-fluorobenzenesulfonamide (4e)
4-Chloro-N,N-diethylbenzenesulfonamide (4f)
4-Bromo-N,N-diethylbenzenesulfonamide (4g)
$N,N$-Diethyl-4-nitrobenzenesulfonamide (4h)
N-(4-(N,N-diethylsulfamoyl)phenyl)acetamide (4i)
4-Chloro-\(N,N\)-dipropylbenzenesulfonamide (4k)
N,N-dipropylbenzenesulfonamide (4l)
N,N-dibutyl-4-methylbenzenesulfonamide (4m)
$N,N$-dibutylbenzenesulfonamide (4n)
$N,N$-Dibutyl-4-chlorobenzenesulfonamide (4o)
4-Tosylmorpholine (4p)
(E)-1-(2-(phenylsulfonyl)vinyl)pyrrolidin-2-one (5a)