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Rhodium-Catalyzed Hydrosilylation Reaction of *N*-Sulfonyl-1,2,3-triazoles with Triphenylsilane: Access to Diverse Compounds

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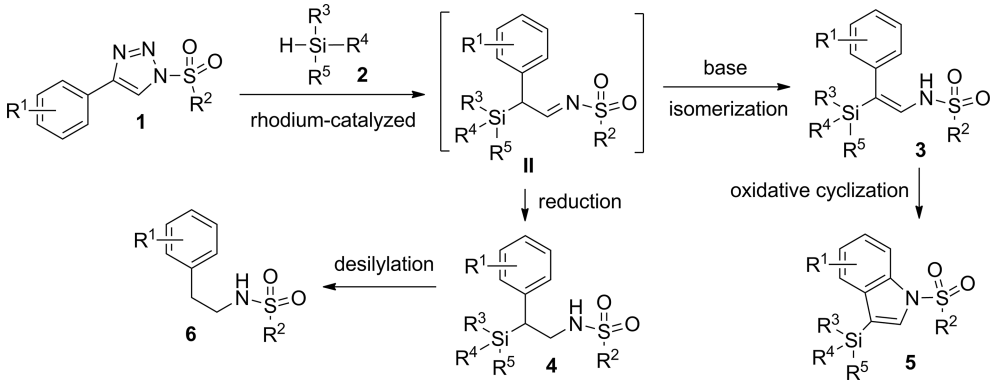
A highly efficient rhodium-catalyzed hydrosilylation of *N*-sulfonyl-1,2,3-triazoles has been developed. The protocol uses readily available *N*-sulfonyl-1,2,3-triazoles and triphenylsilane as starting materials, and the reactions first gave 2-(triphenylsilyl)-2-aryl-*N*-(arylsulfonyl)ethanimines, the isomerization of which provided (*E*)-2-(triphenylsilyl)-2-aryl-*N*-(arylsulfonyl)ethenamines in the presence of triethylamine; the reduction of which with $LiAlH_4$ led to 2-(triphenylsilyl)-2-aryl-*N*-(arylsulfonyl)ethanamines. It is worthwhile to note that the obtained products could be converted into indole and arylethylamine derivatives. Therefore, the highly efficient rhodium-catalyzed hydrosilylation method is a valuable strategy for synthesis of diverse compounds.

Introduction

Organosilicon compounds show similar reactivity to some organometals and organo-metalloids, such as organotin, organozinc, and organoboron reagents, and they provide advantages in terms of low cost, low toxicity, high chemical stability and functional group tolerance. Consequently, organosilicon reagents are often used in the synthesis of biologically active small molecules and complex natural products.[1] In particular, vinylsilanes are very attractive scaffolds and valuable compounds in synthetic organic chemistry,[2] and the transition-metal-catalyzed hydrosilylation reaction of alkynes is the most straightforward and convenient protocol with 100% atom efficiency for the synthesis of vinylsilanes.[3] Importantly, the resulting organosilicon reagents are versatile building blocks in organic syntheses, such as the protodesilylation of vinylsilanes to produce the corresponding alkene,[4] the Hiyama cross-coupling of vinylsilanes with vinyl and aryl halides,[5] and the Tamao–Fleming oxidation of vinylsilanes to generate carbonyl derivatives.[6] Unfortunately, the control of stereo- and regioselectivity is a frequent difficulty encountered in the transition-metal-catalyzed hydrosilylation reaction of alkynes, and the final outcome depends on the catalysts, the alkynes, the silanes, and the reaction conditions, such as solvents and temperature.[7] *N*-Sulfonyl-1,2,3-triazoles are interesting N-heterocyclic compounds that are readily prepared by copper-catalyzed cycloaddition reaction of terminal alkynes with *N*-sulfonyl azides,[8] and they can form α-imino metal carbenes with high reactivity under catalysis by transition metals.[9] Recently, various interesting reactions of *N*-sulfonyl-1,2,3-triazoles have been developed by



Scheme 1. Our strategy for the rhodium-catalyzed hydrosilylation reaction of *N*-sulfonyl-1,2,3-triazoles and further application.

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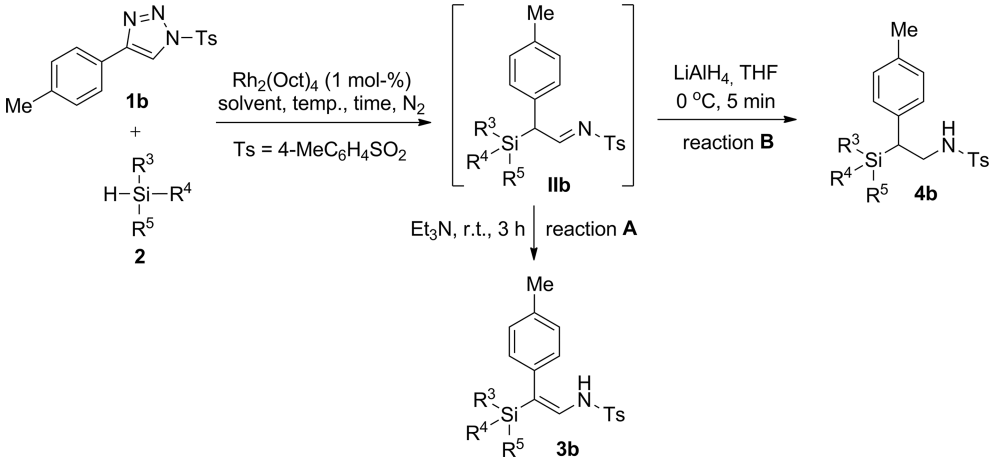
Fokin, Gevorgyan, Miura, Murakami, and other research groups.[9,10] To the best of our knowledge, hydrosilylation reaction of *N*-sulfonyl-1,2,3-triazoles has not been investigated thus far.

In this paper, our strategy is as follows (see also Scheme 1): copper-catalyzed cycloaddition reaction of readily available terminal alkynes and *N*-sulfonyl azides gives *N*-sulfonyl-1,2,3-triazoles (**1**) by using previous methods,[8] rhodium-catalyzed hydrosilylation reaction of **1** with silane (**2**) provides 2-(trialkylsilyl)-2-aryl-*N*-(arylsulfonyl)ethanimines (**II**), isomerization of **II** in the presence of base leads to 2-(trialkylsilyl)-2-aryl-*N*-(arylsulfonyl)ethenamines (**3**), or reduction of **II** affords 2-(trialkylsilyl)-2-aryl-*N*-(arylsulfonyl)ethanamines (**4**). Transition-metal-catalyzed oxidative cyclization reaction of **3** yields indole derivatives (**5**), and desilylation of **4** gives *N*-sulfonyl-2-arylethylamine (**6**).

Results and Discussion

As shown in Table 1, rhodium-catalyzed optimized conditions were first investigated through reaction of hydrosilylation of 4-*p*-tolyl-1-tosyl-1*H*-1,2,3-triazole (**1b**) with trialkylsilane (**2**) that leads to 2-(trialkylsilyl)-2-*p*-tolyl-*N*-tosylethanimine (**IIb**) under nitrogen atmosphere. $Rh_2(Oct)_4$-catalyzed reaction of **1b** with triphenylsilane (**2a**) in $CHCl_3$ at 60 °C for 1 h provided almost quantitative 2-(triphenylsilyl)-2-*p*-tolyl-*N*-tosylethanimine (**IIba**) that was obtained by crystallization in mixed solvent of $CHCl_3$ and hexane (Table 1, Entry 1). The structure of **IIba** was confirmed by ^1H, ^{13}C NMR and mass spectrometry (see Supporting Information for the details). However, **IIba** was not stable under acidic, basic, and neutral aqueous conditions, so the following two procedures were carried out (Reactions **A** and **B**). Triethylamine was added to the resulting solution from reaction of **1b** and **2a**, after a 3 h-treatment, 2-(trialkylsilyl)-2-*p*-tolyl-*N*-tosylethenamine (**3b**) was provided in 93% yield with complete *trans* configuration because of high steric hindrance of triphenylsilyl (Reaction **A**). Reduction of **IIba** with $LiAlH_4$ in tetrahydrofuran (THF) at 0 °C for 5 min afforded 2-(triphenylsilyl)-2-*p*-tolyl-*N*-tosylethanamine (**4b**) in 98% yield (Reaction **B**). Other solvents were screened (Table 1, Entries 2–4), but were inferior to $CHCl_3$, yields decreased when the temperature was changed (Table 1, Entries 1, 5 and 6). Shortened times led to a lower yield (Table 1, Entries 1, 7 and 8). We attempted other trialkylsilanes including dimethylphenylsilane (**2b**), triethylsi-

Table 1. Optimization of conditions for rhodium-catalyzed hydrosilylation reaction of 4-*p*-tolyl-1-tosyl-1*H*-1,2,3-triazole (**1b**) with trialkylsilane (**2**), which leads to 2-(trialkylsilyl)-2-*p*-tolyl-*N*-tosylethanimine (**IIb**), and synthesis of (*E*)-2-(trialkylsilyl)-2-*p*-tolyl-*N*-tosylethenamine (**3b**) and 2-(trialkylsilyl)-2-*p*-tolyl-*N*-tosylethanamine (**4b**).[a]



Entry	R^3, R^4, R^5	Solvent	Temp [°C]	Time [h]	Yield of **3b**/**4b** [%][b]
1	***Ph, Ph, Ph***	***$CHCl_3$***	***60***	***1***	***93:98***
2	Ph, Ph, Ph	DCE	60	1	81:86
3	Ph, Ph, Ph	PhMe	60	1	16:21
4	Ph, Ph, Ph	*o*-xylene	60	1	13:19
5	Ph, Ph, Ph	$CHCl_3$	40	1	10:13
6	Ph, Ph, Ph	$CHCl_3$	80	1	89:96
7	Ph, Ph, Ph	$CHCl_3$	60	0.5	66:72
8	Ph, Ph, Ph	$CHCl_3$	60	2	93:98
9	Me, Me, Ph	$CHCl_3$	60	1	0:0
10	Et, Et, Et	$CHCl_3$	60	1	0:0
11	H, Ph, Ph	$CHCl_3$	60	1	0:0

[a] Reaction conditions: under nitrogen atmosphere, 4-*p*-tolyl-1-tosyl-1*H*-1,2,3-triazole (**1b**; 0.11 mmol), trialkylsilane (**2**; 0.1 mmol), catalyst (0.001 mmol), solvent (1.0 mL), temperature (40–80 °C), and time (0.5–2 h) in a sealed Schlenk tube for the first reaction. For Reaction **A**, triethylamine (0.2 mmol), room temperature (≈ 25 °C), and time (3.0 h); For Reaction **B**, $LiAlH_4$ (0.1 mmol), THF (2.0 mL) at 0 °C for 5 min; Oct = octanoate. DCE = 1,2-dichloroethane. [b] Isolated yield.

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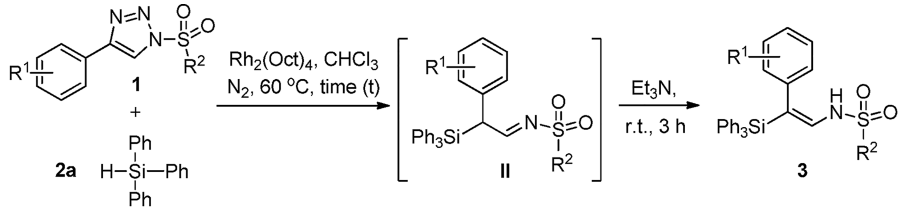
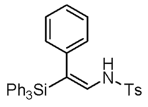
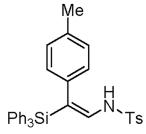
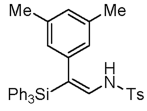
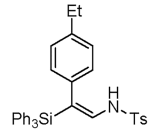
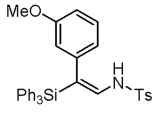
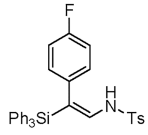
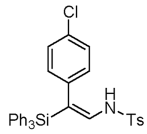
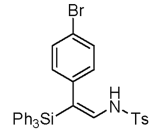
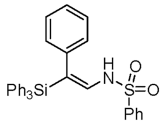
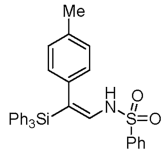
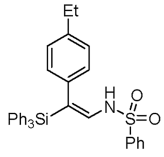
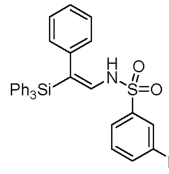
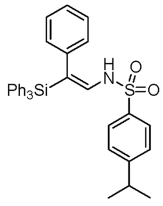
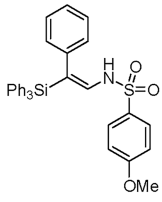
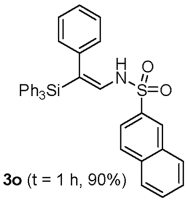
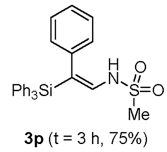
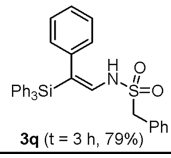
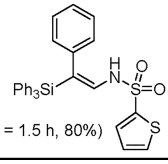
lane (**2c**), and phenylmethylsilane (**2d**; Table 1, Entries 9–11). Unfortunately, no satisfactory results were found. Therefore, the optimal conditions are as follows: 1 mol-% $Rh_2(Oct)_4$ as catalyst, triphenylsilane as the hydrosilylating reagent, $CHCl_3$ as the solvent at 60 °C under nitrogen atmosphere for the first step of the reaction (from starting materials to **II**).

Subsequently, we explored the scope for rhodium-catalyzed hydrosilylation reaction of *N*-sulfonyl-1,2,3-triazoles (**1**) with triphenylsilane (**2a**) and synthesis of **3**. The resulting solution from reaction of **1** with **2a** was cooled to room temperature, and then triethylamine (2 equiv.) was added to the solution. After 3 h, **II** transformed into **3** in good to excellent yields, and only *trans*-**3** was observed as a result of steric hindrance by the triphenylsilyl group (Table 2). For substituents R^1 in **1**, the substrates that contain electron-donating groups showed higher reactivity than those with weak electron-withdrawing groups, and the substrates with strong electron-withdrawing groups, such as NO_2 and CF_3, gave bad results. For substituents R^2 in **1**, the substrates with aryl provided slightly higher yields than those with alkyl (**3p** and **3q**). The two-step reactions from **1** and **2a** to **3** were tolerant of some functional groups including ether (**3e** and **3n**), C–F bond (**3f**), C–Cl

Table 2. Rhodium-catalyzed hydrosilylation reaction of *N*-sulfonyl-1,2,3-triazoles (**1**) with triphenylsilane (**2a**) and synthesis of **3**.[a]



3 (time, yield[b])			
 **3a** (t = 1 h, 89%)	 **3b** (t = 1 h, 93%)	 **3c** (t = 1 h, 95%)	 **3d** (t = 1 h, 93%)
 **3e** (t = 3 h, 84%)	 **3f** (t = 1 h, 89%)	 **3g** (t = 3 h, 81%)	 **3h** (t = 2 h, 83%)
 **3i** (t = 1 h, 91%)	 **3j** (t = 1 h, 85%)	 **3k** (t = 1 h, 88%)	 **3l** (t = 1.5 h, 89%)
 **3m** (t = 1.5 h, 91%)	 **3n** (t = 1 h, 86%)	 **3o** (t = 1 h, 90%)	 **3p** (t = 3 h, 75%)
 **3q** (t = 3 h, 79%)	 **3r** (t = 1.5 h, 80%)		

[a] Conditions from starting materials to **II**: under nitrogen atmosphere, *N*-sulfonyl-1,2,3-triazole (**1**; 0.11 mmol), triphenylsilane (**2a**; 0.1 mmol), $Rh_2(Oct)_4$ (0.001 mmol), $CHCl_3$ (1.0 mL), temperature (60 °C), and time (1–3 h). Conditions from **II** to **3**: Et_3N (0.2 mmol) at room temperature (≈ 25 °C) for 3 h. [b] Isolated yield.

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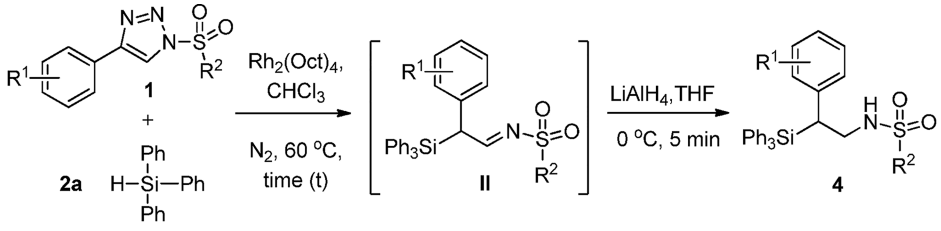
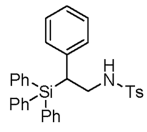
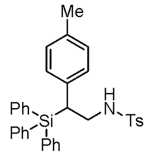
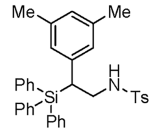
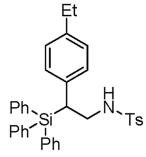
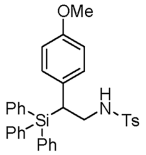
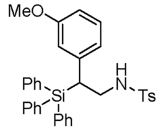
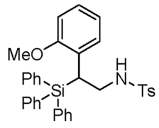
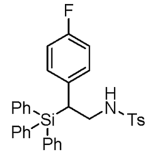
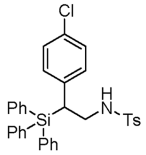
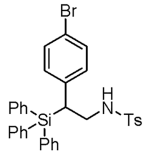
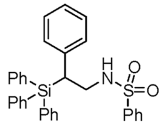
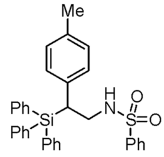
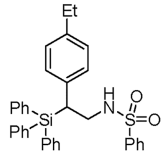
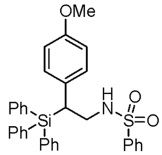
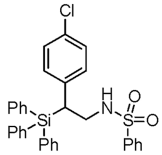
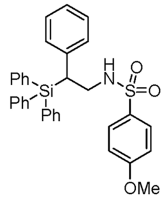
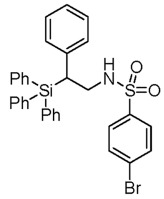
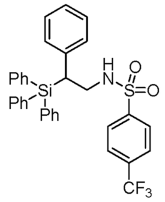
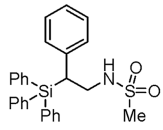
bond (**3g**), C–Br bond (**3h**), naphthyl (**3o**) and *S*-heterocycle (**3r**).

Reaction of **1** with **2a** led to **II** under rhodium-catalysis that was similar to Table 2. The resulting solution was cooled, then THF and $LiAlH_4$ were added to the solution at 0 °C, and the reductive reaction was carried out for 5 min at this temperature (Table 3). 2-(Triphenylsilyl)-2-aryl-*N*-(arylsulfonyl)ethanamines (**4**) were obtained in excellent yields. The two-step reactions (from starting materials to **4**) were tolerant of various functional groups including ether (**4e**–**4g** and **4n**), C–F bond (**4h**), C–Cl bond (**4i** and **4o**), C–Br bond (**4j** and **4q**), and CF_3 (**4r**).

A possible mechanism for the rhodium-catalyzed hydrosilylation reaction of *N*-sulfonyl-1,2,3-triazoles (**1**) with triphenylsilane (**2a**) and synthesis of **3** and **4** is proposed in Scheme 2 in accordance with the results above and previous work.[9,10] Rhodium-catalyzed denitrogenation of **1** leads to α-imino Rh^{II} carbine (**I**), and reaction of **I** with triphenylsi-

Table 3. Rhodium-catalyzed hydrosilylation reaction of *N*-sulfonyl-1,2,3-triazoles (**1**) with triphenylsilane (**2a**) and synthesis of **4**.[a]



4 (time, yield[b])			
 **4a** (t = 1 h, 97%)	 **4b** (t = 1 h, 98%)	 **4c** (t = 1 h, 95%)	 **4d** (t = 1 h, 94%)
 **4e** (t = 1 h, 97%)	 **4f** (t = 3 h, 92%)	 **4g** (t = 6 h, 91%)	 **4h** (t = 1 h, 96%)
 **4i** (t = 3 h, 92%)	 **4j** (t = 2 h, 93%)	 **4k** (t = 1 h, 92%)	 **4l** (t = 1 h, 96%)
 **4m** (t = 1 h, 95%)	 **4n** (t = 1 h, 97%)	 **4o** (t = 3 h, 92%)	 **4p** (t = 1 h, 93%)
 **4q** (t = 1 h, 95%)	 **4r** (t = 1 h, 97%)	 **4s** (t = 3 h, 90%)	

[a] Conditions from starting materials to **II**: under nitrogen atmosphere, *N*-sulfonyl-1,2,3-triazole (**1**; 0.11 mmol), triphenylsilane (**2**; 0.1 mmol), $Rh_2(Oct)_4$ (0.001 mmol), $CHCl_3$ (1.0 mL), temperature (60 °C), and time (1–6 h). Conditions from **II** to **4**: $LiAlH_4$ (0.1 mmol), THF (2.0 mL) at 0 °C for 5 min. [b] Isolated yield.

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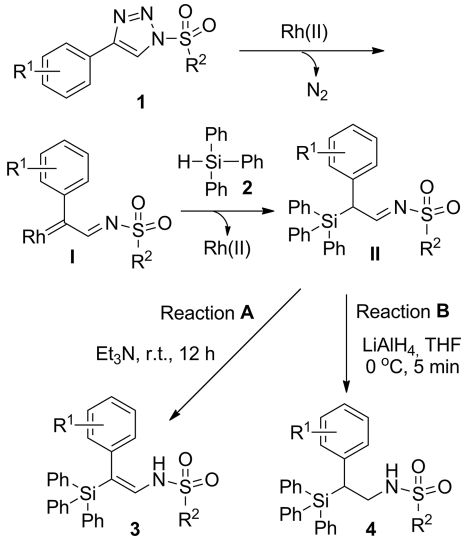
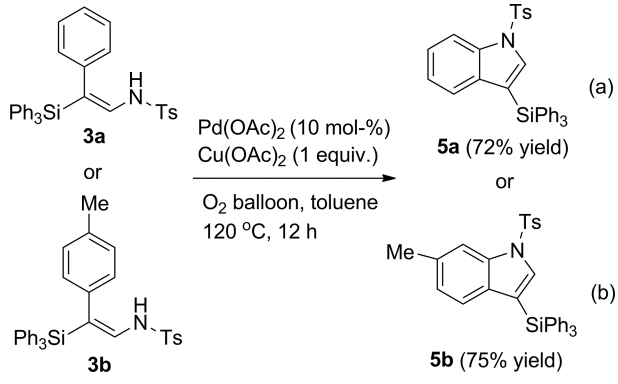
lane (**2a**) provides **II** and frees the Rh^{II} catalyst.[11] Isomerization of **II** in the presence of base (Et_3N) affords **3**, and reduction of **II** with $LiAlH_4$ in THF gives **4**.



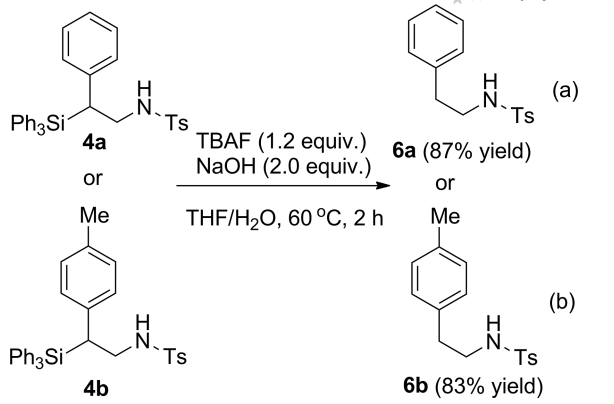
Scheme 2. Possible mechanism for the rhodium-catalyzed hydrosilylation reaction and synthesis of **3** and **4**.

Palladium-catalyzed oxidative cyclization reaction of **3** was investigated by consulting published work.[12] As shown in Scheme 3, $Pd(OAc)_2$-catalyzed oxidation of **3a** or **3b** with $Cu(OAc)_2$ in the presence of oxygen in toluene provided indole derivatives (**5a** or **5b**) in 72 and 75%, respectively.



Scheme 3. Palladium-catalyzed oxidative cyclization reaction of **3a** and **3b**.

We attempted detriphenylsilylation of **4** in the presence of tetra-*n*-butylammonium fluoride (TBAF) and NaOH according to known conditions.[13] As shown in Scheme 4, the deprotection of **4a** or **4b** was successfully performed in mixed solvent of THF and water at 60 °C, and corresponding arylethylamine derivatives **6a** and **6b** were obtained in 87 and 83% yields, respectively. Therefore, the rhodium-catalyzed hydrosilylation method provides access to diverse compounds.



Scheme 4. Detriphenylsilylation of **4a** and **4b** in the presence of TBAF and NaOH.

Conclusions

We have developed a highly efficient rhodium-catalyzed hydrosilylation reaction of *N*-sulfonyl-1,2,3-triazoles for the first time. Reaction of *N*-sulfonyl-1,2,3-triazoles with triphenylsilane first produced 2-(triphenylsilyl)-2-aryl-*N*-(arylsulfonyl)ethanimines, and then they performed the following two procedures: isomerization in the presence of triethylamine led to (*E*)-2-(triphenylsilyl)-2-aryl-*N*-(arylsulfonyl)-ethenamines; the reduction with $LiAlH_4$ provided 2-(triphenylsilyl)-2-aryl-*N*-(arylsulfonyl)ethanamines. It is worthwhile to note that the obtained products with triphenylsilyl could be converted into some useful compounds. Therefore, the highly efficient rhodium-catalyzed hydrosilylation method is a valuable strategy for synthesis of diverse compounds.

Experimental Section

General: Chloroform was dried with calcium hydride, and toluene and THF were dried with sodium. Rhodium(II) octanoate dimer was purchased from Accela Chemicals. ^1H NMR and ^{13}C NMR spectra were recorded in $CDCl_3$ with tetramethylsilane as the internal standard (^1H NMR: TMS at δ = 0.00 ppm, $CHCl_3$ at δ = 7.26 ppm. ^{13}C NMR: $CDCl_3$ at δ = 77.2 ppm).

Synthesis of Compound IIba: A 25 mL Schlenk tube was charged a magnetic stirrer, and the tube was evacuated and refilled with nitrogen three times. 4-(*p*-Tolyl)-1-tosyl-1*H*-1,2,3-triazole (**1b**; 0.11 mmol, 35 mg), triphenylsilane (**2a**; 0.1 mmol, 26 mg), $Rh_2(Oct)_4$ (0.001 mmol, 0.8 mg), and $CHCl_3$ (1.0 mL) were added to the tube under a nitrogen atmosphere, and the tube was sealed and the mixture was stirred at 60 °C for 1 h. The resulting solution was concentrated under reduced pressure, and the residue was crystallized from hexane/ethyl acetate to give desired target product **IIba**.

4-Methyl-*N*-[2-(*p*-tolyl)-2-(triphenylsilyl)ethylidene]benzenesulfonamide (IIba): Yield 54 mg (99%). Yellow solid; m.p. 95–96 °C. ^1H NMR ($CDCl_3$, 400 MHz): δ = 8.83 (d, J = 6.9 Hz, 1 H), 7.53 (d, J = 8.2 Hz, 2 H), 7.42–7.34 (m, 3 H), 7.29–7.12 (m, 14 H), 6.96 (d, J = 7.8 Hz, 2 H), 6.77 (d, J = 7.8 Hz, 2 H), 4.43 (d, J = 6.9 Hz, 1 H), 2.40 (s, 3 H), 2.28 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 179.5, 144.0, 136.5, 136.3, 135.3, 131.2, 131.1, 130.3, 129.6,

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129.4, 129.3, 128.0, 127.8, 47.1, 21.7, 21.1 ppm. HRMS (ESI^+): calcd. for $C_{34}H_{31}NNaO_2SSi$ $[M + Na]^+$ 568.1742; found 568.1741.

General Procedure for Synthesis of Compounds 3 and 4: A 25 mL Schlenk tube was charged with a magnetic stirrer, and the tube was evacuated and refilled with nitrogen three times. *N*-Sulfonyl-1,2,3-triazole (**1**; 0.11 mmol), triphenylsilane (**2a**; 0.1 mmol, 26 mg), $Rh_2(Oct)_4$ (0.001 mmol, 0.8 mg), and $CHCl_3$ (1.0 mL) were added to the tube under a nitrogen atmosphere, and the tube was sealed and the mixture was stirred at 60 °C until the reaction was complete (TLC). The subsequent two different procedures were performed as follows:

For synthesis of **3**: Et_3N (0.2 mmol, 20 mg) was added to the solution, and the mixture was stirred at room temperature for 3 h. The resulting solution was poured into ice/water, and hydrochloric acid (1 M, 0.5 mL) was added. The solution was stirred and extracted with CH_2Cl_2 (3× 2 mL), and the combined organic layer was washed with brine, dried with anhydrous Na_2SO_4, filtered, and concentrated. The residue was purified by column chromatography on silica gel with hexane/ethyl acetate as the eluent to give desired target product **3**.

For synthesis of **4**: The resulting solution from reaction of **1** with **2a** was cooled, and a suspension of $LiAlH_4$ (0.1 mmol, 3.8 mg) in THF (2.0 mL) was added to the solution at 0 °C. The mixture was stirred at 0 °C for 5 min, and then 3.8 mg of H_2O was added. The solution was warmed to room temperature and filtered. The filtrate was concentrated, and the residue was purified by column chromatography on Al_2O_3 with hexane/ethyl acetate as the eluent to give desired target product **4**.

(*E*)-4-Methyl-*N*-[2-phenyl-2-(triphenylsilyl)vinyl]benzenesulfonamide (3a): Eluent: hexane/ethyl acetate (10:1), yield 47 mg (89%). Yellow solid; m.p. 169–170 °C. ^1H NMR ($CDCl_3$, 400 MHz): δ = 7.58 (d, J = 8.4 Hz, 2 H), 7.46–7.37 (m, 3 H), 7.36 (d, J = 8.0 Hz, 2 H), 7.34–7.27 (m, 12 H), 7.20–7.14 (m, 3 H), 6.72–6.64 (m, 2 H), 6.50 (s, 2 H), 2.51 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 144.2, 137.4, 136.9, 136.4, 133.7, 133.3, 130.0, 129.9, 129.3, 128.8, 127.9, 127.1, 126.9, 118.7, 21.8 ppm. HRMS (ESI^+): calcd. for $C_{33}H_{29}NNaO_2SSi$ $[M + Na]^+$ 554.1586; found 554.1584.

(*E*)-4-Methyl-*N*-[2-(p-tolyl)-2-(triphenylsilyl)vinyl]benzenesulfonamide (3b): Eluent: hexane/ethyl acetate (10:1), yield 51 mg (93%). White solid; m.p. 186–187 °C. ^1H NMR ($CDCl_3$, 600 MHz): δ = 7.58 (d, J = 8.3 Hz, 2 H), 7.44–7.38 (m, 3 H), 7.36 (d, J = 8.3 Hz, 2 H), 7.34–7.27 (m, 12 H), 6.99 (d, J = 7.8 Hz, 2 H), 6.57 (d, J = 7.8 Hz, 2 H), 6.54 (d, J = 11.7 Hz, 1 H), 6.48 (d, J = 11.7 Hz, 1 H), 2.51 (s, 3 H), 2.29 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 150 MHz): δ = 144.1, 136.9, 136.7, 136.5, 134.2, 133.7, 133.4, 130.0, 129.8, 128.7, 127.9, 127.0, 118.7, 21.8, 21.2 ppm. HRMS (ESI^+): calcd. for $C_{34}H_{31}NNaO_2SSi$ $[M + Na]^+$ 568.1742; found 568.1738.

(*E*)-*N*-[2-(3,5-Dimethylphenyl)-2-(triphenylsilyl)vinyl]-4-methylbenzenesulfonamide (3c): Eluent: hexane/ethyl acetate (10:1), yield 53 mg (95%). White solid; m.p. 161–162 °C. ^1H NMR ($CDCl_3$, 400 MHz): δ = 7.59 (d, J = 8.2 Hz, 2 H), 7.43–7.38 (m, 3 H), 7.36 (d, J = 8.2 Hz, 2 H), 7.34–7.27 (m, 12 H), 6.78 (s, 1 H), 6.54 (d, J = 11.9 Hz, 1 H), 6.46 (d, J = 11.9 Hz, 1 H), 6.20 (s, 2 H), 2.51 (s, 3 H), 2.10 (s, 6 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 144.1, 138.6, 137.0, 136.9, 136.5, 133.47, 133.44, 129.9, 129.8, 128.7, 127.8, 127.0, 126.6, 119.6, 21.8, 21.3 ppm. HRMS (ESI^+): calcd. for $C_{35}H_{33}NNaO_2SSi$ $[M + Na]^+$ 582.1899; found 582.1896.

(*E*)-*N*-[2-(4-Ethylphenyl)-2-(triphenylsilyl)vinyl]-4-methylbenzenesulfonamide (3d): Eluent: hexane/ethyl acetate (10:1), yield 52 mg (93%). White solid; m.p. 184–185 °C. ^1H NMR ($CDCl_3$, 400 MHz): δ = 7.59 (d, J = 8.2 Hz, 2 H), 7.43–7.38 (m, 3 H), 7.36 (d, J = 8.2 Hz, 2 H), 7.34–7.27 (m, 12 H), 7.01 (d, J = 7.8 Hz, 2 H), 6.60 (d, J = 7.28 Hz, 2 H), 6.59 (d, J = 11.9 Hz, 1 H), 6.49 (d, J = 11.9 Hz, 1 H), 2.59 (q, J = 7.8 Hz, 2 H), 2.51 (s, 3 H), 1.21 (t, J = 7.8 Hz, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 144.1, 143.1, 136.9, 136.5, 134.4, 133.6, 133.4, 130.0, 129.8, 128.77, 128.75, 127.9, 127.0, 118.7, 28.6, 21.8, 15.6 ppm. HRMS (ESI^+): calcd. for $C_{35}H_{33}NNaO_2SSi$ $[M + Na]^+$ 582.1899; found 582.1898.

(*E*)-*N*-[2-(3-Methoxyphenyl)-2-(triphenylsilyl)vinyl]-4-methylbenzenesulfonamide (3e): Eluent: hexane/ethyl acetate (7:1), yield 47 mg (84%). Off-white solid; m.p. 149–150 °C. ^1H NMR ($CDCl_3$, 600 MHz): δ = 7.59 (d, J = 8.2 Hz, 2 H), 7.44–7.39 (m, 3 H), 7.36 (d, J = 8.2 Hz, 2 H), 7.34–7.27 (m, 12 H), 7.59 (t, J = 7.6 Hz, 1 H), 6.71 (dd, J = 8.3, J = 2.0 Hz, 1 H), 6.61 (d, J = 12.4 Hz, 1 H), 6.50 (d, J = 11.6 Hz, 1 H), 6.31 (d, J = 7.6 Hz, 1 H), 6.17 (d, J = 2.0 Hz, 1 H), 3.48 (s, 3 H), 2.51 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 150 MHz): δ = 160.1, 144.2, 138.8, 136.9, 139.5, 133.6, 133.3, 130.3, 130.0, 129.9, 127.9, 127.0, 120.9, 118.5, 113.8, 113.3, 55.0, 21.8 ppm. HRMS (ESI^+): calcd. for $C_{34}H_{31}NNaO_3SSi$ $[M + Na]^+$ 584.1692; found 584.1696.

(*E*)-*N*-[2-(4-Fluorophenyl)-2-(triphenylsilyl)vinyl]-4-methylbenzenesulfonamide (3f): Eluent: hexane/ethyl acetate (10:1), yield 49 mg (89%). White solid; m.p. 163–164 °C. ^1H NMR ($CDCl_3$, 600 MHz): δ = 7.59 (d, J = 8.2 Hz, 2 H), 7.45–7.40 (m, 3 H), 7.37 (d, J = 8.2 Hz, 2 H), 7.34–7.27 (m, 12 H), 6.90–6.85 (m, 2 H), 6.66–6.62 (m, 2 H), 6.54 (d, J = 11.7 Hz, 1 H), 6.47 (d, J = 11.7 Hz, 1 H), 2.51 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 150 MHz): δ = 161.9 (d, J = 244.2 Hz), 144.3, 136.8, 136.4, 134.1, 133.0, 130.6, 130.5, 130.05, 129.97, 128.0, 126.9, 117.6, 116.3 (d, J = 20.1 Hz), 21.8 ppm. HRMS (ESI^+): calcd. for $C_{33}H_{28}FNNaO_2SSi$ $[M + Na]^+$ 572.1492; found 572.1495.

(*E*)-*N*-[2-(4-Chlorophenyl)-2-(triphenylsilyl)vinyl]-4-methylbenzenesulfonamide (3g): Eluent: hexane/ethyl acetate (10:1), yield 46 mg (81%). Off-white solid; m.p. 164–165 °C. ^1H NMR ($CDCl_3$, 400 MHz): δ = 7.58 (d, J = 8.2 Hz, 2 H), 7.45–7.40 (m, 3 H), 7.36 (d, J = 8.2 Hz, 2 H), 7.32–7.28 (m, 12 H), 7.15 (d, J = 8.2 Hz, 2 H), 6.61 (d, J = 8.2 Hz, 2 H), 6.53 (d, J = 11.9 Hz, 1 H), 6.43 (d, J = 11.9 Hz, 1 H), 2.51 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 144.3, 136.8, 136.4, 135.9, 134.1, 133.1, 132.9, 130.3, 130.06, 130.02, 129.5, 128.0, 126.9, 117.4, 21.8 ppm. HRMS (ESI^+): calcd. for $C_{33}H_{28}ClNNaO_2SSi$ $[M + Na]^+$ 588.1196; found 588.1191.

(*E*)-*N*-[2-(4-Bromophenyl)-2-(triphenylsilyl)vinyl]-4-methylbenzenesulfonamide (3h): Eluent: hexane/ethyl acetate (10:1), yield 51 mg (83%). White solid; m.p. 165–166 °C. ^1H NMR ($CDCl_3$, 400 MHz): δ = 7.59 (d, J = 8.2 Hz, 2 H), 7.45–7.41 (m, 3 H), 7.36 (d, J = 8.2 Hz, 2 H), 7.35–7.28 (m, 14 H), 6.55 (d, J = 8.2 Hz, 2 H), 6.53 (d, J = 11.9 Hz, 1 H), 6.44 (d, J = 11.9 Hz, 1 H), 2.51 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 144.3, 136.8, 136.4, 134.0, 132.9, 132.4, 130.6, 130.06, 130.03, 128.0, 126.9, 121.2, 117.3, 21.8 ppm. HRMS (ESI^+): calcd. for $C_{33}H_{28}BrNNaO_2SSi$ $[M + Na]^+$ 632.0691; found 632.0688.

(*E*)-*N*-[2-Phenyl-2-(triphenylsilyl)vinyl]benzenesulfonamide (3i): Yield 47 mg (91%). Eluent: hexane/ethyl acetate (10:1). White solid; m.p. 161–162 °C. ^1H NMR ($CDCl_3$, 400 MHz): δ = 7.74–7.65 (m, 3 H), 7.61–7.54 (m, 2 H), 7.44–7.37 (m, 3 H), 7.35–7.27 (m, 12 H), 7.20–7.14 (m, 3 H), 6.70–6.64 (m, 2 H), 6.55 (d, J = 11.9 Hz, 1 H), 6.51 (d, J = 11.9 Hz, 1 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 139.8, 137.4, 136.4, 133.5, 133.3, 133.2, 130.0, 129.4, 129.3, 128.8, 127.9, 127.1, 126.9, 119.3 ppm. HRMS (ESI^+): calcd. for $C_{32}H_{27}NNaO_2SSi$ $[M + Na]^+$ 540.1429; found 540.1433.

(*E*)-*N*-[2-(*p*-Tolyl)-2-(triphenylsilyl)vinyl]benzenesulfonamide (3j): Eluent: hexane/ethyl acetate (10:1), yield 45 mg (85%). White solid;

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m.p. 169–170 °C. ^{1}H NMR ($CDCl_3$, 600 MHz): δ = 7.70 (d, J = 7.6 Hz, 2 H), 7.69–7.66 (m, 1 H), 7.60–7.55 (m, 2 H), 7.44–7.38 (m, 3 H), 7.36–7.27 (m, 12 H), 6.98 (d, J = 8.2 Hz, 2 H), 6.57 (s, 1 H), 6.55 (d, J = 7.6 Hz, 2 H), 6.49 (s, 1 H), 2.29 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 150 MHz): δ = 139.7, 136.8, 136.4, 134.1, 133.5, 133.3, 130.0, 129.8, 129.4, 128.6, 127.9, 126.9, 119.2, 21.2 ppm. HRMS (ESI$^+$): calcd. for $C_{33}H_{29}NNaO_2SSi$ [M + Na]$^+$ 554.1586; found 554.1592.

(*E*)-*N*-[2-(4-Ethylphenyl)-2-(triphenylsilyl)vinyl]benzenesulfonamide (3k): Eluent: hexane/ethyl acetate (10:1), yield 48 mg (88%). White solid; m.p. 147–148 °C. ^{1}H NMR ($CDCl_3$, 600 MHz): δ = 7.70 (d, J = 8.3 Hz, 2 H), 7.69–7.66 (m, 1 H), 7.60–7.55 (m, 2 H), 7.43–7.37 (m, 3 H), 7.33–7.27 (m, 12 H), 7.00 (d, J = 7.6 Hz, 2 H), 6.59 (d, J = 11.0 Hz, 1 H), 6.57 (d, J = 7.6 Hz, 2 H), 6.48 (d, J = 11.0 Hz, 1 H), 2.58 (q, J = 7.6 Hz, 2 H), 1.20 (t, J = 7.6 Hz, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 150 MHz): δ = 143.2, 139.8, 136.5, 134.3, 133.4, 133.3, 133.2, 129.8, 129.4, 128.79, 128.72, 127.9, 126.9, 119.2, 28.6, 15.6 ppm. HRMS (ESI$^+$): calcd. for $C_{34}H_{31}NNaO_2SSi$ [M + Na]$^+$ 568.1742; found 568.1743.

(*E*)-3-Methyl-*N*-[2-phenyl-2-(triphenylsilyl)vinyl]benzenesulfonamide (3l): Eluent: hexane/ethyl acetate (10:1), yield 47 mg (89%). White solid; m.p. 157–158 °C. ^{1}H NMR ($CDCl_3$, 600 MHz): δ = 7.54–7.50 (m, 2 H), 7.50–7.45 (m, 2 H), 7.44–7.39 (m, 3 H), 7.36–7.27 (m, 12 H), 7.20–7.15 (m, 3 H), 6.71–6.66 (m, 2 H), 6.54 (d, J = 11.6 Hz, 1 H), 6.51 (d, J = 11.6 Hz, 1 H), 2.47 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 150 MHz): δ = 139.7, 139.6, 137.4, 136.4, 134.1, 133.6, 133.2, 130.0, 129.3, 128.8, 127.9, 127.17, 127.12, 124.0, 119.0, 21.5 ppm. HRMS (ESI$^+$): calcd. for $C_{33}H_{29}NNaO_2SSi$ [M + Na]$^+$ 554.1586; found 554.1590.

(*E*)-4-Isopropyl-*N*-[2-phenyl-2-(triphenylsilyl)vinyl]benzenesulfonamide (3m): Eluent: hexane/ethyl acetate (10:1), yield 51 mg (91%). White solid; m.p. 196–197 °C. ^{1}H NMR ($CDCl_3$, 600 MHz): δ = 7.63 (d, J = 8.2 Hz, 2 H), 7.44–7.39 (m, 5 H), 7.35–7.27 (m, 12 H), 7.20–7.15 (m, 3 H), 6.72–6.66 (m, 2 H), 6.57–6.51 (m, 2 H), 3.11–3.00 (m, 1 H), 1.34 (d, J = 6.9 Hz, 6 H) ppm. ^{13}C NMR ($CDCl_3$, 150 MHz): δ = 154.9, 137.4, 137.1, 136.4, 133.7, 133.3, 129.9, 129.3, 128.9, 127.9, 127.5, 127.1, 118.6, 34.4, 23.8 ppm. HRMS (ESI$^+$): calcd. for $C_{35}H_{33}NNaO_2SSi$ [M + Na]$^+$ 582.1899; found 582.1904.

(*E*)-4-Methoxy-*N*-[2-phenyl-2-(triphenylsilyl)vinyl]benzenesulfonamide (3n): Eluent: hexane/ethyl acetate (7:1), yield 47 mg (86%). White solid; m.p. 177–178 °C. ^{1}H NMR ($CDCl_3$, 600 MHz): δ = 7.63 (d, J = 8.9 Hz, 2 H), 7.43–7.38 (m, 3 H), 7.36–7.27 (m, 12 H), 7.20–7.16 (m, 3 H), 7.01 (d, J = 8.9 Hz, 2 H), 6.72–6.67 (m, 2 H), 6.51 (d, J = 11.6 Hz, 1 H), 6.49 (d, J = 11.6 Hz, 1 H), 3.94 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 150 MHz): δ = 163.4, 137.5, 136.5, 133.8, 133.3, 131.4, 129.9, 129.3, 129.1, 128.9, 127.9, 127.1, 118.7, 114.5, 55.9 ppm. HRMS (ESI$^+$): calcd. for $C_{33}H_{29}NNaO_3SSi$ [M + Na]$^+$ 570.1535; found 570.1531.

(*E*)-*N*-[2-Phenyl-2-(triphenylsilyl)vinyl]naphthalene-2-sulfonamide (3o): Eluent: hexane/ethyl acetate (10:1), yield 51 mg (90%). White solid; m.p. 183–184 °C. ^{1}H NMR ($CDCl_3$, 600 MHz): δ = 8.29 (s, 1 H), 7.08–7.97 (m, 3 H), 7.78–7.65 (m, 3 H), 7.41–7.35 (m, 3 H), 7.28–7.19 (m, 12 H), 7.19–7.13 (m, 3 H), 6.70–6.63 (m, 3 H), 6.56 (d, J = 12.4 Hz, 1 H) ppm. ^{13}C NMR ($CDCl_3$, 150 MHz): δ = 137.4, 136.5, 136.4, 135.1, 133.5, 133.1, 132.3, 129.8, 129.5, 129.3, 129.2, 128.8, 128.4, 128.2, 128.0, 127.9, 127.1, 121.9, 119.2 ppm. HRMS (ESI$^+$): calcd. for $C_{36}H_{29}NNaO_2SSi$ [M + Na]$^+$ 590.1586; found 590.1588.

(*E*)-*N*-[2-Phenyl-2-(triphenylsilyl)vinyl]methanesulfonamide (3p): Eluent: hexane/ethyl acetate (7:1), yield 34 mg (75%). White solid; m.p. 167–168 °C. ^{1}H NMR ($CDCl_3$, 600 MHz): δ = 7.46–7.38 (m, 9 H), 7.37–7.30 (m, 6 H), 7.26–7.18 (m, 3 H), 6.90 (d, J = 8.3 Hz, 2 H), 6.58 (d, J = 11.7 Hz, 1 H), 6.46 (d, J = 11.7 Hz, 1 H), 2.96 (s, 2 H) ppm. ^{13}C NMR ($CDCl_3$, 150 MHz): δ = 137.5, 136.5, 133.2, 133.0, 129.9, 129.4, 129.0, 128.0, 127.2, 117.8, 41.6 ppm. HRMS (ESI$^+$): calcd. for $C_{27}H_{25}NNaO_2SSi$ [M + Na]$^+$ 478.1273; found 478.1268.

(*E*)-1-Phenyl-*N*-[2-phenyl-2-(triphenylsilyl)vinyl]methanesulfonamide (3q): Eluent: hexane/ethyl acetate (7:1), yield 42 mg (79%). Off-white solid; m.p. 192–193 °C. ^{1}H NMR ($CDCl_3$, 600 MHz): δ = 7.45–7.40 (m, 3 H), 7.40–7.27 (m, 17 H), 7.20–7.13 (m, 3 H), 6.80 (d, J = 7.6 Hz, 2 H), 6.39 (d, J = 11.7 Hz, 1 H), 6.31 (d, J = 11.7 Hz, 1 H), 4.24 (s, 2 H) ppm. ^{13}C NMR ($CDCl_3$, 150 MHz): δ = 137.5, 136.5, 133.5, 133.2, 130.8, 129.8, 129.22, 129.17, 129.09, 128.98, 128.4, 127.9, 127.1, 116.1, 60.1 ppm. HRMS (ESI$^+$): calcd. for $C_{33}H_{29}NNaO_2SSi$ [M + Na]$^+$ 554.1586; found 554.1584.

(*E*)-*N*-[2-Phenyl-2-(triphenylsilyl)vinyl]thiophene-2-sulfonamide (3r): Eluent: hexane/ethyl acetate (10:1), yield 42 mg (80%). Off-white solid; m.p. 156–157 °C. ^{1}H NMR ($CDCl_3$, 600 MHz): δ = 7.68 (dd, J = 6.2, J = 1.4 Hz, 1 H), 7.50 (dd, J = 4.1, J = 1.4 Hz, 1 H), 7.44–7.39 (m, 3 H), 7.37–7.27 (m, 12 H), 7.22–7.18 (m, 3 H), 7.18–7.15 (m, 1 H), 6.74–6.69 (m, 2 H), 6.62 (d, J = 11.6 Hz, 1 H), 6.55 (d, J = 11.6 Hz, 1 H) ppm. ^{13}C NMR ($CDCl_3$, 150 MHz): δ = 140.5, 137.3, 136.5, 133.09, 133.07, 132.7, 132.6, 129.9, 129.3, 128.8, 127.9, 127.7, 127.2, 120.1 ppm. HRMS (ESI$^+$): calcd. for $C_{30}H_{25}NNaO_2S_2Si$ [M + Na]$^+$ 546.0994; found 546.0991.

4-Methyl-*N*-[2-phenyl-2-(triphenylsilyl)ethyl]benzenesulfonamide (4a): Yield 52 mg (97%). Off-white solid; m.p. 166–167 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.57 (d, J = 8.2 Hz, 2 H), 7.43–7.31 (m, 3 H), 7.32–7.20 (m, 14 H), 7.26–7.03 (m, 3 H), 6.62 (d, J = 6.9 Hz, 2 H), 4.31 (dd, J = 6.4, J = 2.3 Hz, 1 H), 3.76–3.66 (m, 1 H), 3.39 (dt, J = 12.8, J = 2.8 Hz, 1 H), 3.06 (dd, J = 12.8, J = 3.7 Hz, 1 H), 2.42 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 143.4, 138.1, 137.0, 136.3, 132.3, 130.0, 129.7, 129.4, 128.8, 128.0, 127.3, 126.4, 45.2, 35.8, 21.7 ppm. HRMS (ESI$^+$): calcd. for $C_{33}H_{31}NNaO_2SSi$ [M + Na]$^+$ 556.1742; found 556.1739.

4-Methyl-*N*-[2-(*p*-tolyl)-2-(triphenylsilyl)ethyl]benzenesulfonamide (4b): Yield 54 mg (98%). White solid; m.p. 198–199 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.57 (d, J = 6.9 Hz, 2 H), 7.42–7.34 (m, 3 H), 7.32–7.18 (m, 14 H), 6.89 (d, J = 7.4 Hz, 2 H), 6.51 (d, J = 6.4 Hz, 2 H), 4.29 (d, J = 8.7 Hz, 1 H), 3.73–3.63 (m, 1 H), 3.35 (t, J = 12.8 Hz, 1 H), 3.00 (d, J = 11.5 Hz, 1 H), 2.43 (s, 3 H), 2.27 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 143.4, 137.0, 136.3, 135.9, 134.7, 132.5, 130.0, 129.7, 129.5, 129.3, 128.0, 127.3, 45.2, 35.1, 21.7, 21.1 ppm. HRMS (ESI$^+$): calcd. for $C_{34}H_{33}NNaO_2SSi$, [M + Na]$^+$ 570.1899; found 570.1896.

***N*-[2-(3,5-Dimethylphenyl)-2-(triphenylsilyl)ethyl]-4-methylbenzenesulfonamide (4c):** Yield 53 mg (95%). Off-white solid; m.p. 154–155 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.57 (d, J = 8.2 Hz, 2 H), 7.43–7.34 (m, 3 H), 7.33–7.18 (m, 14 H), 6.74 (s, 1 H), 6.11 (s, 2 H), 4.29 (d, J = 7.8 Hz, 1 H), 3.73–3.63 (m, 1 H), 3.30 (dt, J = 12.8, J = 1.8 Hz, 1 H), 2.96 (dd, J = 12.8, J = 3.7 Hz, 1 H), 2.42 (s, 3 H), 2.05 (s, 6 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 143.3, 137.9, 137.2, 136.8, 136.4, 136.3, 132.4, 129.9, 129.6, 128.0, 127.9,127.3, 44.9, 35.0, 21.6, 21.2 ppm. HRMS (ESI$^+$): calcd. for $C_{35}H_{35}NNaO_2SSi$ [M + Na]$^+$ 584.2055; found 584.2051.

***N*-[2-(4-Ethylphenyl)-2-(triphenylsilyl)ethyl]-4-methylbenzenesulfonamide (4d):** Yield 53 mg (94%). White solid; m.p. 181–182 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.58 (d, J = 8.2 Hz, 2 H), 7.42–7.35 (m, 3 H), 7.32–7.18 (m, 14 H), 6.92 (d, J = 8.2 Hz, 2 H), 6.53 (d, J = 8.2 Hz, 2 H), 4.28 (d, J = 7.8 Hz, 1 H), 3.74–3.64 (m, 1 H), 3.37 (dt, J = 12.8, J = 1.8 Hz, 1 H), 3.00 (dd, J = 12.8, J = 3.7 Hz,

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1 H), 2.58 (q, *J* = 7.8 Hz, 2 H), 2.44 (s, 3 H), 1.21 (d, *J* = 7.8 Hz, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 143.4, 142.5, 137.1, 136.3, 134.9, 132.6, 129.9, 129.7, 129.3, 128.3, 128.0, 127.4, 45.3, 35.2, 28.5, 21.7, 15.8 ppm. HRMS (ESI$^+$): calcd. for $C_{35}H_{35}NNaO_2SSi$ [M + Na]$^+$ 584.2055; found 584.2054.

***N*-[2-(4-Methoxyphenyl)-2-(triphenylsilyl)ethyl]-4-methylbenzenesulfonamide (4e):** Yield 55 mg (97%). Off-white solid; m.p. 173–174 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.57 (d, *J* = 8.3 Hz, 2 H), 7.42–7.35 (m, 3 H), 7.32–7.20 (m, 14 H), 6.63 (d, *J* = 8.7 Hz, 2 H), 6.53 (d, *J* = 8.7 Hz, 2 H), 4.32 (dd, *J* = 8.7, *J* = 2.3 Hz, 1 H), 3.74 (s, 3 H), 3.74–3.63 (m, 1 H), 3.32 (dt, *J* = 12.8, *J* = 2.3 Hz, 1 H), 3.00 (dd, *J* = 12.8, *J* = 3.7 Hz, 1 H), 2.42 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 158.2, 143.3, 137.0, 136.3, 132.5, 130.3, 130.0, 129.7, 129.6, 128.0, 127.3, 114.2, 55.3, 45.3, 34.5, 21.6 ppm. HRMS (ESI$^+$): calcd. for $C_{34}H_{33}NNaO_3SSi$ [M + Na]$^+$ 586.1848; found 586.1852.

***N*-[2-(3-Methoxyphenyl)-2-(triphenylsilyl)ethyl]-4-methylbenzenesulfonamide (4f):** Yield 52 mg (92%). Yellow solid; m.p. 161–162 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.56 (d, *J* = 8.2 Hz, 2 H), 7.44–7.37 (m, 3 H), 7.34–7.21 (m, 14 H), 7.03 (t, *J* = 7.8 Hz, 1 H), 6.68 (dd, *J* = 8.2, *J* = 2.3 Hz, 1 H), 6.31 (d, *J* = 7.8 Hz, 1 H), 6.06 (s, 1 H), 4.28 (dd, *J* = 8.7, *J* = 2.3 Hz, 1 H), 3.75–3.65 (m, 1 H), 3.39 (s, 3 H), 3.35 (dt, *J* = 12.8, *J* = 2.8 Hz, 1 H), 3.02 (dd, *J* = 12.8, *J* = 3.2 Hz, 1 H) 2.43 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 159.8, 143.4, 139.6, 136.9, 136.3, 132.4, 130.0, 129.7, 129.6, 128.0, 127.3, 122.1, 113.4, 113.2, 54.8, 45.3, 35.9, 21.7 ppm. HRMS (ESI$^+$): calcd. for $C_{34}H_{33}NNaO_3SSi$ [M + Na]$^+$ 586.1848; found 586.1844.

***N*-[2-(2-Methoxyphenyl)-2-(triphenylsilyl)ethyl]-4-methylbenzenesulfonamide (4g):** Yield 51 mg (91%). Yellow solid; m.p. 165–166 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.54 (d, *J* = 8.4 Hz, 2 H), 7.40–7.31 (m, 3 H), 7.30–7.14 (m, 14 H), 7.08 (t, *J* = 7.8 Hz, 1 H), 6.64 (t, *J* = 7.8 Hz, 2 H), 6.43 (d, *J* = 7.4 Hz, 1 H), 4.26 (d, *J* = 7.4 Hz, 1 H), 3.70–3.58 (m, 2 H), 3.42 (t, *J* = 12.8 Hz, 1 H), 3.26 (s, 3 H), 2.42 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 157.5, 143.1, 136.8, 136.1, 133.0, 129.7, 129.6, 128.5, 127.8, 127.3, 127.2, 126.4, 120.7, 110.7, 54.7, 44.4, 27.3, 21.7 ppm. HRMS (ESI$^+$): calcd. for $C_{34}H_{33}NNaO_3SSi$ [M + Na]$^+$ 586.1848; found 586.1851.

***N*-[2-(4-Fluorophenyl)-2-(triphenylsilyl)ethyl]-4-methylbenzenesulfonamide (4h):** Yield 53 mg (96%). White solid; m.p. 169–170 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.54 (d, *J* = 6.9 Hz, 2 H), 7.44–7.34 (m, 3 H), 7.33–7.15 (m, 14 H), 6.79–6.69 (m, 2 H), 6.62–6.52 (m, 2 H), 4.40 (d, *J* = 7.3 Hz, 1 H), 3.74–3.64 (m, 1 H), 3.33 (t, *J* = 12.8 Hz, 1 H), 3.08 (d, *J* = 12.8 Hz, 1 H), 2.42 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 161.5 (d, *J* = 243.1 Hz), 143.4, 136.9, 136.2, 133.9, 132.2, 130.7 (d, *J* = 7.6 Hz), 130.1, 129.7, 128.1, 127.2, 115.5 (d, *J* = 21.0 Hz), 45.3, 35.2, 21.6 ppm. HRMS (ESI$^+$): calcd. for $C_{33}H_{30}FNNaO_2SSi$ [M + Na]$^+$ 574.1648; found 574.1640.

***N*-[2-(4-Chlorophenyl)-2-(triphenylsilyl)ethyl]-4-methylbenzenesulfonamide (4i):** Yield 52 mg (92%). Off-white solid; m.p. 189–190 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.53 (d, *J* = 7.8 Hz, 2 H), 7.44–7.35 (m, 3 H), 7.34–7.22 (m, 12 H), 7.21 (d, *J* = 7.8 Hz, 2 H), 7.01 (d, *J* = 8.2 Hz, 2 H), 6.54 (d, *J* = 8.2 Hz, 2 H), 4.44 (dd, *J* = 7.3, *J* = 3.9 Hz, 1 H), 3.74–3.64 (m, 1 H), 3.33 (dt, *J* = 12.8, *J* = 3.7 Hz, 1 H), 3.09 (dd, *J* = 12.8, *J* = 2.8 Hz, 1 H), 2.42 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 143.5, 137.0, 136.9, 136.2, 132.1, 132.0, 130.6, 130.1, 129.7, 128.7, 128.1, 127.2, 45.2, 35.6, 21.7 ppm. HRMS (ESI$^+$): calcd. for $C_{33}H_{30}ClNNaO_2SSi$ [M + Na]$^+$ 590.1353; found 590.1347.

***N*-[2-(4-Bromophenyl)-2-(triphenylsilyl)ethyl]-4-methylbenzenesulfonamide (4j):** Yield 57 mg (93%). White solid; m.p. 192–193 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.52 (d, *J* = 8.2 Hz, 2 H), 7.46–7.36 (m, 3 H), 7.35–7.26 (m, 12 H), 7.21 (d, *J* = 7.8 Hz, 2 H), 7.16 (d, *J* = 8.2 Hz, 2 H), 6.48 (d, *J* = 8.2 Hz, 2 H), 4.40 (dd, *J* = 7.8, *J* = 3.7 Hz, 1 H), 3.75–3.65 (m, 1 H), 3.32 (dt, *J* = 12.8, *J* = 3.6 Hz, 1 H), 3.08 (dd, *J* = 12.8, *J* = 3.2 Hz, 1 H), 2.43 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 143.5, 137.6, 139.9, 136.2, 132.0, 131.7, 131.0, 130.1, 129.7, 128.1, 127.2, 120.0, 45.1, 35.7, 21.7 ppm. HRMS (ESI$^+$): calcd. for $C_{33}H_{30}BrNNaO_2SSi$ [M + Na]$^+$ 634.0848; found 634.0852.

***N*-[2-Phenyl-2-(triphenylsilyl)ethyl]benzenesulfonamide (4k):** Yield 48 mg (92%). White solid; m.p. 162–163 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.68 (d, *J* = 7.1 Hz, 2 H), 7.55 (t, *J* = 7.6 Hz, 1 H), 7.44 (t, *J* = 7.6 Hz, 2 H), 7.41–7.35 (m, 3 H), 7.33–7.19 (m, 12 H), 7.15–7.10 (m, 1 H), 7.06 (t, *J* = 7.6 Hz, 2 H), 6.61 (d, *J* = 7.4 Hz, 2 H), 4.34 (dd, *J* = 8.7, *J* = 2.3 Hz, 1 H), 3.79–3.69 (m, 1 H), 3.40 (dt, *J* = 12.8, *J* = 2.3 Hz, 1 H), 3.05 (dd, *J* = 12.8, *J* = 3.7 Hz, 1 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 140.0, 138.0, 136.3, 132.7, 132.3, 130.0, 129.3, 129.1, 128.8, 128.0, 127.2, 126.4, 45.3, 35.8 ppm. HRMS (ESI$^+$): calcd. for $C_{32}H_{29}NNaO_2SSi$ [M + Na]$^+$ 542.1586; found 542.1585.

***N*-[2-(*p*-Tolyl)-2-(triphenylsilyl)ethyl]benzenesulfonamide (4l):** Yield 51 mg (96%). Off-white solid; m.p. 179–180 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.68 (d, *J* = 7.8 Hz, 2 H), 7.55 (t, *J* = 7.4 Hz, 1 H), 7.44 (t, *J* = 7.8 Hz, 2 H), 7.42–7.35 (m, 3 H), 7.34–7.18 (m, 12 H), 6.88 (d, *J* = 7.8 Hz, 2 H), 6.49 (d, *J* = 7.8 Hz, 2 H), 4.31 (d, *J* = 8.3 Hz, 1 H), 3.76–3.66 (m, 1 H), 3.36 (t, *J* = 12.4 Hz, 1 H), 3.00 (dd, *J* = 12.8, *J* = 3.2 Hz, 1 H), 2.27 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 140.0, 136.3, 136.0, 134.6, 132.6, 132.5, 130.0, 129.5, 129.2, 129.1, 128.0, 127.2, 45.3, 35.1, 21.1 ppm. HRMS (ESI$^+$): calcd. for $C_{33}H_{31}NNaO_2SSi$, [M + Na]$^+$ 556.1742; found 556.1740.

***N*-[2-(4-Ethylphenyl)-2-(triphenylsilyl)ethyl]benzenesulfonamide (4m):** Yield 52 mg (95%). Off-white solid; m.p. 165–166 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.69 (d, *J* = 7.8 Hz, 2 H), 7.56 (t, *J* = 7.3 Hz, 1 H), 7.45 (t, *J* = 7.8 Hz, 2 H), 7.42–7.35 (m, 3 H), 7.33–7.18 (m, 12 H), 6.91 (d, *J* = 8.2 Hz, 2 H), 6.52 (d, *J* = 7.8 Hz, 2 H), 4.32 (d, *J* = 7.8 Hz, 1 H), 3.76–3.66 (m, 1 H), 3.38 (dt, *J* = 12.8, 2.3 Hz, 1 H), 2.99 (dd, *J* = 12.8, *J* = 3.7 Hz, 1 H), 2.58 (q, *J* = 7.8 Hz, 2 H), 1.21 (t, *J* = 7.8 Hz, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 142.5, 140.0, 136.3, 134.9, 132.7, 132.5, 130.0, 129.3, 129.1, 128.3, 128.0, 127.3, 45.3, 35.2, 28.5, 15.7 ppm. HRMS (ESI$^+$): calcd. for $C_{34}H_{33}NNaO_2SSi$ [M + Na]$^+$ 570.1899; found 570.1895.

***N*-[2-(4-Methoxyphenyl)-2-(triphenylsilyl)ethyl]benzenesulfonamide (4n):** Yield 53 mg (97%). White solid; m.p. 154–155 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.68 (d, *J* = 7.4 Hz, 2 H), 7.55 (t, *J* = 7.3 Hz, 1 H), 7.44 (t, *J* = 7.8 Hz, 2 H), 7.42–7.35 (m, 3 H), 7.33–7.18 (m, 12 H), 6.63 (d, *J* = 8.7 Hz, 2 H), 6.52 (d, *J* = 8.7 Hz, 2 H), 4.32 (d, *J* = 8.7 Hz, 1 H), 3.76–3.66 (m, 1 H), 3.75 (s, 3 H), 3.33 (dt, *J* = 12.8, 2.3 Hz, 1 H), 2.99 (dd, *J* = 12.8, *J* = 3.7 Hz, 1 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 158.2, 140.0, 136.3, 132.7, 132.5, 130.3, 130.0, 129.6, 129.1, 128.0, 127.2, 114.3, 55.4, 45.4, 34.6 ppm. HRMS (ESI$^+$): calcd. for $C_{33}H_{31}NNaO_3SSi$ [M + Na]$^+$ 572.1692; found 572.1688.

***N*-[2-(4-Chlorophenyl)-2-(triphenylsilyl)ethyl]benzenesulfonamide (4o):** Yield 51 mg (92%). Off-white solid; m.p. 172–173 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.66 (d, *J* = 7.8 Hz, 2 H), 7.56 (t, *J* = 7.3 Hz, 1 H), 7.51–7.37 (m, 5 H), 7.36–7.16 (m, 12 H), 7.03 (d, *J* = 7.4 Hz, 2 H), 6.53 (d, *J* = 7.8 Hz, 2 H), 4.37 (d, *J* = 8.4 Hz, 1 H), 3.78–3.66 (m, 1 H), 3.34 (dt, *J* = 12.8, 2.3 Hz, 1 H), 3.08 (dd, *J* = 12.4, *J* = 2.3 Hz, 1 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 139.9, 136.9, 136.2, 132.7, 132.1, 132.0, 130.6, 130.2, 129.1, 128.8,

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128.1, 127.2, 45.2, 35.6 ppm. HRMS (ESI$^+$): calcd. for $C_{32}H_{28}ClNNaO_2SSi$ [M + Na]$^+$ 576.1196; found 576.1194.

4-Methoxy-*N*-[2-phenyl-2-(triphenylsilyl)ethyl]benzenesulfonamide (4p): Yield 51 mg (93%). Yellow solid; m.p. 175–176 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.61 (d, J = 7.8 Hz, 2 H), 7.44–7.35 (m, 3 H), 7.34–7.18 (m, 12 H), 7.16–7.04 (m, 3 H), 6.90 (d, J = 7.3 Hz, 2 H), 6.63 (d, J = 7.8 Hz, 2 H), 4.28 (d, J = 8.2 Hz, 1 H), 3.86 (s, 3 H), 3.74–3.64 (m, 1 H), 3.39 (t, J = 12.8 Hz, 1 H), 3.07 (dd, J = 12.8, J = 2.7 Hz, 1 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 162.9, 138.1, 136.3, 132.4, 131.5, 130.0, 129.4, 129.3, 128.8, 128.0, 126.4, 114.2, 55.7, 45.2, 35.8 ppm. HRMS (ESI$^+$): calcd. for $C_{33}H_{31}NNaO_3SSi$ [M + Na]$^+$ 572.1692; found 572.1693.

4-Bromo-*N*-[2-phenyl-2-(triphenylsilyl)ethyl]benzenesulfonamide (4q): Yield 57 mg (95%). Off-white solid; m.p. 185–186 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.55 (d, J = 8.8 Hz, 2 H), 7.49 (d, J = 8.4 Hz, 2 H), 7.45–7.36 (m, 3 H), 7.34–7.19 (m, 12 H), 7.16–7.11 (m, 1 H), 7.11–7.04 (m, 2 H), 6.63 (d, J = 8.0 Hz, 2 H), 4.41 (d, J = 7.8 Hz, 1 H), 3.74–3.64 (m, 1 H), 3.39 (t, J = 12.8 Hz, 1 H), 3.07 (d, J = 12.4 Hz, 1 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 138.9, 138.0, 136.3, 132.3, 132.2, 130.1, 129.3, 128.8, 128.7, 128.1, 127.6, 126.5, 45.4, 36.0 ppm. HRMS (ESI$^+$): calcd. for $C_{32}H_{28}BrNNaO_2SSi$ [M + Na]$^+$ 620.0691; found 620.0688.

***N*-[2-Phenyl-2-(triphenylsilyl)ethyl]-4-(trifluoromethyl)benzenesulfonamide (4r):** Yield 57 mg (97%). Off-white solid; m.p. 138–139 °C. ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.74 (d, J = 6.9 Hz, 2 H), 7.66 (d, J = 6.9 Hz, 2 H), 7.45–7.36 (m, 3 H), 7.34–7.19 (m, 12 H), 7.15–7.09 (m, 1 H), 7.08–7.01 (m, 2 H), 6.61 (d, J = 6.9 Hz, 2 H), 4.51 (d, J = 7.8 Hz, 1 H), 3.78–3.68 (m, 1 H), 3.40 (t, J = 12.8 Hz, 1 H), 3.08 (d, J = 12.8 Hz, 1 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 143.5, 137.9, 136.3, 134.2 (q, J = 33.4 Hz), 132.2, 130.1, 129.3, 128.8, 128.1, 127.6, 126.5, 126.2, 123.4 (q, J = 271.7 Hz), 45.5, 36.1 ppm. HRMS (ESI$^+$): calcd. for $C_{33}H_{28}F_3NNaO_2SSi$ [M + Na]$^+$ 610.1460; found 610.1456.

***N*-[2-Phenyl-2-(triphenylsilyl)ethyl]methanesulfonamide (4s):** Yield 41 mg (90%). Off-white solid; m.p. 185–186 °C. ^{1}H NMR ($CDCl_3$, 600 MHz): δ = 7.47–7.42 (m, 3 H), 7.40–7.28 (m, 12 H), 7.21–7.14 (m, 3 H), 6.89–6.83 (m, 2 H), 4.16 (dd, J = 8.2, J = 3.4 Hz, 1 H), 3.93–3.85 (m, 1 H), 3.59 (dt, J = 13.0, J = 4.1 Hz, 1 H), 3.24 (dd, J = 12.4, J = 3.4 Hz, 1 H), 2.69 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 150 MHz): δ = 138.6, 136.3, 132.5, 130.1, 129.6, 128.9, 128.1, 126.6, 45.9, 40.5, 36.9 ppm. HRMS (ESI$^+$): calcd. for $C_{27}H_{27}NNaO_2SSi$ [M + Na]$^+$ 480.1429; found 480.1420.

General Procedure for Synthesis of Compounds 5:[14] An oven-dried 25 mL Schlenk tube was cooled under vacuum. Compound **3** (0.1 mmol), $Pd(OAc)_2$ (0.01 mmol, 2.2 mg), and $Cu(OAc)_2$ (0.1 mmol, 18 mg) were added to the tube. The tube was evacuated and refilled with O_2 three times. The reaction was stirred at 120 °C under O_2 balloon for 12 h (TLC). The reaction mixture was concentrated under reduced pressure, and the residue was purified by column chromatography on silica gel with hexane/ethyl acetate as the eluent to give desired target product **5**.

1-Tosyl-3-(triphenylsilyl)-1*H*-indole (5a): Eluent: hexane/ethyl acetate (15:1), yield 38 mg (72%). Off-white solid; m.p. 135–136 °C. ^{1}H NMR ($CDCl_3$, 600 MHz): δ = 7.97 (d, J = 8.2 Hz, 1 H), 7.75 (d, J = 8.3 Hz, 2 H), 7.62–7.56 (m, 6 H), 7.49 (s, 1 H), 7.47–7.41 (m, 3 H), 7.40–7.33 (m, 6 H), 7.28 (t, J = 6.9 Hz, 1 H), 7.25 (d, J = 8.3 Hz, 2 H), 7.18 (d, J = 8.3 Hz, 1 H), 7.06 (t, J = 6.9 Hz, 1 H), 2.37 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 100 MHz): δ = 145.2, 136.2, 136.1, 135.9, 135.3, 134.9, 133.8, 130.1, 130.0, 128.2, 127.1, 124.6, 123.5, 123.4, 113.6, 113.3, 21.8 ppm. HRMS (ESI$^+$): calcd. for $C_{33}H_{27}NNaO_2SSi$ [M + Na]$^+$ 552.1429; found 552.1426.

6-Methyl-1-tosyl-3-(triphenylsilyl)-1*H*-indole (5b): Eluent: hexane/ethyl acetate (15:1), yield 41 mg (75%). Yellow solid; m.p. 144–145 °C. ^{1}H NMR ($CDCl_3$, 600 MHz): δ = 7.80 (s, 1 H), 7.75 (d, J = 8.3 Hz, 2 H), 7.60–7.53 (m, 6 H), 7.47–7.41 (m, 4 H), 7.40–7.33 (m, 6 H), 7.25 (d, J = 6.9 Hz, 2 H), 7.06 (d, J = 7.6 Hz, 1 H), 6.89 (d, J = 8.2 Hz, 1 H), 2.45 (s, 3 H), 2.38 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 150 MHz): δ = 145.1, 136.7, 136.2, 135.47, 135.42, 134.8, 133.9, 132.6, 130.1, 130.0, 128.2, 127.0, 124.9, 123.1, 113.7, 113.2, 22.0, 21.8 ppm. HRMS (ESI$^+$): calcd. for $C_{34}H_{29}NNaO_2SSi$ [M + Na]$^+$ 566.1586; found 566.1581.

General Procedure for Synthesis of Compounds 6:[15] To a stirred solution of compound **4** (0.1 mmol) in THF (1.0 mL) was added a solution of NaOH (0.2 mmol, 8 mg) in H_2O (0.1 mL), followed by TBAF·3H_2O (0.12 mmol, 38 mg). The mixture was stirred at 60 °C for 2 h (TLC). The resulting solution was extracted with ethyl acetate (3 × 1.0 mL), and the combined organic layer was washed with brine, dried with anhydrous Na_2SO_4, filtered, and concentrated. The residue was purified by column chromatography on silica gel with hexane/ethyl acetate as the eluent to give desired target product **6**.

4-Methyl-*N*-phenethylbenzenesulfonamide (6a): Eluent: hexane/ethyl acetate (10:1), yield 24 mg (87%). Yellow solid; m.p. 49–50 °C (ref.[16] 51–53 °C). ^{1}H NMR ($CDCl_3$, 600 MHz): δ = 7.69 (d, J = 8.3 Hz, 2 H), 7.31–7.24 (m, 4 H), 7.24–7.19 (m, 1 H), 7.08 (d, J = 6.9 Hz, 2 H), 4.45 (t, J = 5.5 Hz, 1 H), 3.21 (q, J = 6.8 Hz, 2 H), 2.75 (t, J = 6.8 Hz, 2 H), 2.42 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 150 MHz): δ = 143.6, 137.8, 136.9, 129.8, 128.88, 128.85, 127.2, 126.9, 44.3, 35.9, 21.7 ppm. MS (ESI): m/z = 298.2 [M + Na]$^+$.

4-Methyl-*N*-(4-methylphenethyl)benzenesulfonamide (6b): Eluent: hexane/ethyl acetate (15:1), yield 24 mg (83%). Off-white solid; m.p. 84–85 °C. ^{1}H NMR ($CDCl_3$, 600 MHz): δ = 7.69 (d, J = 8.2 Hz, 2 H), 7.28 (d, J = 7.6 Hz, 2 H), 7.07 (d, J = 7.6 Hz, 2 H), 6.96 (d, J = 7.6 Hz, 2 H), 4.48 (t, J = 6.2 Hz, 1 H), 3.18 (q, J = 6.9 Hz, 2 H), 2.71 (t, J = 6.9 Hz, 2 H), 2.43 (s, 3 H), 2.31 (s, 3 H) ppm. ^{13}C NMR ($CDCl_3$, 150 MHz): δ = 143.5, 137.0, 136.5, 129.8, 129.5, 128.7, 127.2, 44.4, 35.4, 21.6, 21.1 ppm. HRMS (ESI$^+$): calcd. for $C_{16}H_{19}NNaO_2S$ [M + Na]$^+$ 312.1034; found 312.1028.

Supporting Information (see footnote on the first page of this article): Copies of ^{1}H and ^{13}C NMR spectra of compounds **IIba**, **3**, **4**, **5**, and **6**.

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