Supporting Information

One-Pot Synthesis of Hydrazono-Sulfonamide Adducts using Cu(BTC) MOF Catalyst and Their Remarkable AIEE Properties: Unprecedented Copper(II)-Catalyzed Generation of Ketenimine

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General Methods

All reactions were carried out under aerobic conditions. Unless stated otherwise, all solvents and chemicals were obtained from commercial sources and used without further purification. Analytical thin layer chromatography (TLC) was performed on precoated silica gel-G plates (Merck) using a mixture of petroleum ether (60-80 °C) and ethyl acetate (7:3) as eluent. The $^1$H and $^{13}$C NMR spectra were recorded on a Bruker (Avance) 300 MHz instrument using TMS as an internal standard and CDCl$_3$ as solvent. Chemical shifts are expressed in parts per million (ppm) and the coupling constants ($J$ values) are expressed in hertz (Hz). The following abbreviations are used to indicate spin multiplicities: s (singlet), d (doublet), t (triplet), sept (septet), m (multiplet). The powder XRD pattern of the catalyst sample was performed on X’Pert PANalytical Diffractometer – Version 3.0 instrument using a Cu Kα radiation at room temperature with sample stage PW3071/60. FT-IR spectra were recorded on SHIMADZU FT-IR-8400S instrument using KBr pellet technique in the range of 4000–400 cm$^{-1}$. Elemental analyses were carried out with Perkin-Elmer 2400 series II analyzer. Melting points were determined in open capillaries and were uncorrected. Tosyl azide$^1$ was prepared by adopting reported method. Absorption measurements were carried out in Agilent single beam UV-Diode Array spectrophotometer. Fluorescence spectra were recorded in Agilent Cary Eclipse Fluorescence spectrophotometer. The slit width was 5 nm for both excitation and emission.

Procedure for synthesis of Cu(BTC) MOF

The Cu(BTC) MOF was prepared following the procedure reported by Yaghi et al.$^2$ A mixture of benzenetricarboxylic acid (BTC) (3 mmol) and Cu(OAc)$_2$.H$_2$O (5.43 mmol) was stirred in a mixture of DMF/EtOH/H$_2$O (1:1:1, 30 mL) at room temperature. To the clear solution obtained was added triethylamine (3.57 mmol). The reaction mixture was stirred for 23 h. The product formed was collected by filtration and washed with DMF (2 × 32 mL). It was dispersed in DCM (HPLC grade, 63 mL) overnight. Next day, the solvent was decanted and the solid was washed with fresh DCM (3 × 63 mL). It was then dried under vacuum at 130 °C for 12 h. Cu(BTC) MOF was obtained as deep blue colored solid in 47% yield.
General procedure for Cu(BTC) MOF catalyzed four component coupling reactions

To the stirring mixture of aldehyde 1 (1 mmol) and phenylhydrazine 3 (1 mmol) in DCM (3 mL) was added alkyne 2 (1 mmol), azide 4 (1 mmol) and activated Cu(BTC) MOF (1 mol%). To the above mixture, triethylamine (1.1 mmol) was added slowly. The whole reaction mixture was allowed to agitated for 5 min at room temperature and then filtered to separate the catalyst from reaction mixture. To the filtrate was added petroleum ether and ethyl acetate mixture (1:1, 20 mL) and resulting mixture was stirred for 10 min. About 75% of solvent mixture was distilled off from filtrate under vacuum at 70 °C. The above crude product was cooled to 0 to 5 °C and triturated immediately in 5-8 min to afford white solid which was collected by filtration. The recovered catalyst was thoroughly washed with DCM and air dried for 10 min before using it for next reaction.

The crystal structure of compound 5a has been deposited at the Cambridge Crystallographic Data Centre and allocated the deposition number CCDC 1023738

References
Characterization Data for Cu(BTC) MOF

Figure 1. Structure of Cu(BTC)
**Figure 2.** FT-IR spectra of Cu(BTC)

**Figure 3.** Powder XRD pattern of Cu(BTC)
Figure 4. Color changes of 5r under day light (a) and UV light (b) with Water:THF mixtures
Characterization Data for all Products
4-methyl-N-(1-((E)-2-(4-methylbenzylidene)-1-phenylhydrazinyl)-2 phenylethylidene)benzenesulfonamide (5a)

White solid; Isolated yield 95% (0.38g); mp 169-171 °C; \( ^1H \) NMR (300 MHz, CDCl\(_3\)): \( \delta \) 7.53 – 7.50 (m, 4H), 7.46 (d, \( J = 8.1 \) Hz ,2H), 7.35 (d, \( J = 8.1 \) Hz ,2H), 7.31 – 7.27 (m, 3H), 7.22 – 7.20 (m, 2H), 7.17 – 7.10 (m, 6H), 4.96 (s, 2H), 2.34 & 2.33 (2 s, 6H); \( ^13C \) NMR (75 MHz, CDCl\(_3\)): \( \delta \) 167.9, 145.4, 141.8, 140.8, 140.7, 136.4, 135.8, 130.8, 130.1, 129.4, 129.3, 128.8, 128.8, 128.5, 127.4, 126.5, 126.1, 37.0, 21.4, 21.3; MS (ESI) m/z \([M+H]^+\): 482.2; Anal. Caled for: C\(_{29}\)H\(_{27}\)N\(_3\)O\(_2\)S: C, 72.32; H, 5.65; N, 8.72%. Found C, 72.36; H, 5.63; N, 8.76%.

\[ \text{N-(1-((E)-2-(4-methoxybenzylidene)-1-phenylhydrazinyl)-2-phenylethylidene)-4-methylbenzenesulfonamide (5b)} \]

White solid; Isolated yield 93% (0.34g); mp 179-181 °C; \( ^1H \) NMR (300 MHz, CDCl\(_3\)): \( \delta \) 7.55 – 7.45 (m, 7H), 7.40 (d, \( J = 8.7 \) Hz ,2H), 7.31 – 7.27 (m, 2H), 7.21 – 7.16 (m, 2H), 7.10 – 7.11 (m, 4H), 6.84 (d, \( J = 8.7 \) Hz ,2H), 4.95 (s, 2H), 3.80 (s, 3H), 2.32 (s, 3H); \( ^13C \) NMR (75 MHz, CDCl\(_3\)): \( \delta \) 167.8, 161.6, 145.2, 141.8, 140.8, 136.6, 135.9, 130.1, 129.3, 129.2, 128.8, 128.7, 128.5, 126.3, 126.1, 114.2, 55.4, 37.0, 21.3; MS (ESI) m/z \([M+H]^+\): 498.2; Anal. Caled for: C\(_{29}\)H\(_{27}\)N\(_3\)O\(_3\)S: C, 70.00; H, 5.47; N, 8.44%. Found C, 70.02; H, 5.44; N, 8.42%.

\[ \text{N-(1-((E)-2-(4-isopropylbenzylidene)-1-phenylhydrazinyl)-2-phenylethylidene)-4-methylbenzenesulfonamide (5c)} \]

White solid; Isolated yield 93% (0.32g); mp 171-173 °C; \( ^1H \) NMR (300 MHz, CDCl\(_3\)): \( \delta \) 7.55 – 7.45 (m, 7H), 7.38 (d, \( J = 8.1 \) Hz ,2H), 7.32 – 7.27 (m, 2H), 7.24 – 7.20 (m, 3H), 7.17 (s, 1H), 7.10 – 7.06 (m, 4H), 4.95 (s, 2H), 2.89 (sept, \( J = 6.9 \) Hz ,1H), 2.32 (s, 3H), 1.22 (d, \( J = 6.9 \) Hz ,6H); \( ^13C \) NMR (75 MHz, CDCl\(_3\)): \( \delta \) 167.9, 151.8, 145.4, 141.8, 140.7, 136.5, 135.8, 131.2, 130.1, 129.3, 128.8, 128.8, 128.5, 127.7, 126.8, 126.5, 34.1, 23.7, 21.3; MS (ESI) m/z \([M+H]^+\): 510.3; Anal. Caled for: C\(_{31}\)H\(_{31}\)N\(_3\)O\(_2\)S: C, 73.05; H, 6.13; N, 8.24%. Found C, 73.00; H, 6.17; N, 8.27%.
**N-(1-(E)-2-(2-ethoxybenzylidene)-1-phenylhydrazinyl)-2-phenylethylidene)-4-methylbenzenesulfonamide (5d)**

White solid; Isolated yield 91% (0.31g); mp 150-152 °C; \(^1H\) NMR (300 MHz, CDCl\(_3\)): \(\delta\) 7.71 (d, \(J = 10.2\) Hz, 2H), 7.55 – 7.44 (m, 7H), 7.32 – 7.27 (m, 3H), 7.22 – 7.17 (m, 1H), 7.09 (t, \(J = 7.5\) Hz, 4H), 6.93 (d, \(J = 7.5\) Hz, 1H), 6.77 (d, \(J = 8.4\) Hz, 1H), 4.97 (s, 2H), 3.85 (q, \(J = 6.9\) Hz, 2H), 2.33 (s, 3H), 2.29 (s, 3H), 1.12 (t, \(J = 6.9\) Hz, 3H); \(^13C\) NMR (75 MHz, CDCl\(_3\)): \(\delta\) 167.9, 157.8, 142.2, 141.7, 140.8, 136.7, 135.9, 131.7, 129.9, 129.1, 128.9, 128.7, 128.6, 128.4, 126.4, 126.3, 126.0, 122.3, 120.8, 112.4, 64.0, 37.0, 21.3; MS (ESI) m/z [M+H]\(^+\): 511.2; Anal. Calcd for: C\(_{30}\)H\(_{29}\)N\(_3\)O\(_3\)S: C, 70.43; H, 5.71; N, 8.21%. Found C, 70.41; H, 5.75; N, 8.24%.

**N-(1-(E)-2-(3-methoxybenzylidene)-1-phenylhydrazinyl)-2-phenylethylidene)-4-methylbenzenesulfonamide (5e)**

White solid; Isolated yield 90% (0.33g); mp 151-153 °C; \(^1H\) NMR (300 MHz, CDCl\(_3\)): \(\delta\) 7.56 – 7.46 (m, 6H), 7.31 – 7.17 (m, 6H), 7.11 – 7.04 (m, 5H), 6.96 – 6.87 (m, 2H), 4.96 (s, 2H), 3.77 (s, 3H), 2.33 (s, 3H); \(^13C\) NMR (75 MHz, CDCl\(_3\)): \(\delta\) 167.9, 159.9, 145.1, 141.9, 140.6, 136.3, 135.7, 134.9, 130.1, 129.6, 129.4, 128.8, 128.7, 128.6, 128.5, 126.5, 126. 1, 120.9, 117.1, 111.3, 55.3, 37.1, 21.3; MS (ESI) m/z [M+H]\(^+\): 498.2; Anal. Calcd for: C\(_{29}\)H\(_{27}\)N\(_3\)O\(_3\)S: C, 70.00; H, 5.47; N, 8.44%. Found C, 70.41; H, 5.49; N, 8.41%.

**N-(1-(E)-2-(2-methoxybenzylidene)-1-phenylhydrazinyl)-2-phenylethylidene)-4-methylbenzenesulfonamide (5f)**

White solid; Isolated yield 90% (0.33g); mp 180-182 °C; \(^1H\) NMR (300 MHz, CDCl\(_3\)): \(\delta\) 7.65 (d, \(J = 6.0\) Hz, 1H), 7.60 (s, 1H), 7.47 – 7.37 (m, 7H), 7.26 – 7.17 (m, 4H), 7.11 (t, \(J = 7.5\) Hz, 1H), 7.01 (t, \(J = 7.5\) Hz, 1H), 6.86 (t, \(J = 7.5\) Hz, 1H), 6.70 (d, \(J = 9.0\) Hz, 1H), 4.90 (s, 2H), 3.55 (s, 3H), 2.25 (s, 3H); \(^13C\) NMR (75 MHz, CDCl\(_3\)): \(\delta\) 168.0, 158.1, 141.8, 141.6, 140.6, 136.4, 135.7, 131.7, 130.0, 129.3, 128.8, 128.6, 128.5, 126.5, 126. 1, 120.7, 110.9, 55.3, 36.9, 21.3; MS (ESI) m/z [M+H]\(^+\): 498.2; Anal. Calcd for: C\(_{29}\)H\(_{27}\)N\(_3\)O\(_3\)S: C, 70.00; H, 5.47; N, 8.44%. Found C, 70.04; H, 5.49; N, 8.47%.
**N-(1-((E)-2-(2,4-dimethoxybenzylidene)-1-phenylhydrazinyl)-2-phenylethylidene)-4-methylbenzenesulfonamide (5g)**

White solid; Isolated yield 87% (0.27g); mp 173-175 °C; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 7.67 (d, \(J = 8.4\) Hz, 1H), 7.59 (s, 1H), 7.55 – 7.44 (m, 7H), 7.31 – 7.26 (m, 2H), 7.22 – 7.17 (m, 1H), 7.08 (t, \(J = 8.1\) Hz, 4H), 6.49 (dd, \(J = 2.3\) Hz, 1H), 6.32 (d, \(J = 2.4\) Hz, 1H), 4.94 (s, 2H), 3.82 (s, 3H), 3.62 (s, 2H), 2.33 (s, 3H); \(^1^3\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 167.7, 163.1, 159.7, 141.9, 141.6, 141.0, 136.8, 136.0, 129.9, 129.1, 128.9, 128.7, 128.4, 127.8, 126.4, 126.0, 115.3, 106.8, 98.1, 55.4 (2 carbons merged), 37.0, 21.3; MS (ESI) m/z [M+H]\(^+\): 528.2; Anal. Calcd for: C\(_{30}\)H\(_{29}\)N\(_3\)O\(_4\)S: C, 68.29; H, 5.54; N, 7.96%. Found C, 68.34; H, 5.52; N, 7.99%.

**N-(1-((E)-2-(4-ethylbenzylidene)-1-phenylhydrazinyl)-2-phenylethylidene)-4-methylbenzenesulfonamide (5h)**

White solid; Isolated yield 94% (0.35g); mp 159-161 °C; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 7.55 – 7.45 (m, 7H), 7.37 (d, \(J = 8.1\) Hz, 2H), 7.29 (t, \(J = 7.5\) Hz, 2H), 7.21 (s, 1H), 7.19 – 7.14 (m, 3H), 7.10 – 7.06 (m, 4H), 4.97 (s, 2H), 2.63 (q, \(J = 7.5\) Hz, 2H), 2.32 (s, 3H), 1.21 (t, \(J = 7.5\) Hz, 3H); \(^1^3\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 167.9, 147.2, 145.4, 141.8, 140.7, 136.4, 141.6, 141.0, 136.0, 129.9, 129.1, 128.9, 128.7, 128.5, 128.2, 127.7, 126.5, 126.0, 36.9, 28.8, 21.3, 15.1; MS (ESI) m/z [M+H]\(^+\): 496.2; Anal. Calcd for: C\(_{29}\)H\(_{29}\)N\(_2\)O\(_2\)S: C, 72.70; H, 5.90; N, 8.48%. Found C, 72.75; H, 5.87; N, 8.46%.

**N-(1-((E)-2-benzylidene-1-phenylhydrazinyl)-2-phenylethylidene)-4-methylbenzenesulfonamide (5i)**

White solid; Isolated yield 92% (0.40g); mp 169-171 °C; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 7.56 – 7.44 (m, 9H), 7.34 – 7.25 (m, 5H), 7.22 – 7.17 (m, 2H), 7.11 – 7.06 (m, 3H), 4.97 (s, 2H), 2.32 (s, 3H); \(^1^3\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 168.0, 145.2, 141.9, 140.6, 136.4, 135.7, 133.6, 130.4, 130.1, 129.4, 128.8, 128.7, 128.7, 128.5, 127.6, 126.5, 126.1, 37.0, 21.3; MS (ESI) m/z [M+H]\(^+\): 468.02; Anal. Calcd for: C\(_{28}\)H\(_{28}\)N\(_3\)O\(_2\): C, 71.92; H, 5.39; N, 8.99%. Found C, 71.88; H, 5.42; N, 9.02%.
4-methyl-N-(1-((E)-2-(4-(methylsulfonyl)benzylidene)-1-phenylhydrazinyl)-2-phenylethylidene)benzenesulfonamide (5j)

White solid; Isolated yield 88% (0.26g); mp 167-168 °C; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 7.87 (d, \(J = 8.1\) Hz, 2H), 7.60 – 7.53 (m, 5H), 7.49 – 7.44 (m, 4H), 7.34 – 7.19 (m, 5H), T.12 (d, \(J = 6.4\) Hz, 4H), 4.96 (s, 2H), 3.03 (s, 3H), 2.34 (s, 3H); \(^1\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 168.1, 142.2, 141.6, 140.2, 138.7, 135.9, 135.5, 130.3, 129.8, 128.9, 128.7, 128.5, 128.4, 128.1, 127.7, 126.7, 126.1, 44.3, 37.2, 21.3; MS (ESI) m/z [M+H]: 546.1; Anal. Calcd for: C\(_{29}\)H\(_{27}\)N\(_3\)O\(_4\)S\(_2\): C, 63.83; H, 4.99; N, 7.70%. Found C, 63.87; H, 5.04; N, 7.67%.

N-(1-((E)-2-(4-fluorobenzylidene)-1-phenylhydrazinyl)-2-phenylethylidene)-4-methylbenzenesulfonamide (5k)

White solid; Isolated yield 91% (0.35g); \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 7.56 – 7.40 (m, 9H), 7.29 (t, \(J = 7.2\) Hz, 2H ), 7.22 – 7.18 (m, 2H), 7.10 – 7.06 (m, 4H), 7.00 (t, \(J = 8.7\) Hz, 2H ), 4.95 (s, 2H), 2.32 (s, 3H); \(^1\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 167.9, 165.6, 162.3, 143.9, 141.9, 140.6, 136.2, 135.7, 130.1, 129.9, 129.8, 129.5, 129.4, 128.8, 128.6, 129.5, 126.5, 126.0, 116.0, 115.7, 37.1, 21.3; MS (ESI) m/z [M+H]: 486.2; Anal. Calcd for: C\(_{28}\)H\(_{24}\)FN\(_3\)O\(_2\)S: C, 69.26; H, 4.98; N, 8.65%. Found C, 69.24; H, 4.95; N, 8.68%.

N-(1-((E)-2-(4-chlorobenzylidene)-1-phenylhydrazinyl)-2-phenylethylidene)-4-methylbenzenesulfonamide (5l)

White solid; Isolated yield 88% (0.31g); mp 178-179 °C; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 7.56 – 7.45 (m, 8H), 7.36 (d, \(J = 8.4\) Hz, 2H ), 7.31 - 7.27 (m, 3H ), 7.20 (d, \(J = 7.5\) Hz, 1H), 7.16 (s, 1H), 7.09 – 7.06 (m, 4H), 4.95 (s, 2H), 2.32 (s, 3H); \(^1\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 168.0, 143.6, 142.0, 140.3, 136.2, 135.9, 135.6, 131.9, 130.1, 129.5, 128.9, 128.8, 128.6, 128.5, 128.5126.5, 125.9, 37.0, 21.3. MS (ESI) m/z [M+H]: 502.1; Anal. Calcd for: C\(_{28}\)H\(_{24}\)ClN\(_3\)O\(_2\)S: C, 66.99; H, 4.82; N, 8.37%. Found C, 66.72; H, 4.80; N, 8.33%. 


**N-(1-((E)-2-(4-bromobenzylidene)-1-phenylhydrazinyl)-2-phenylethylidene)-4-methylbenzenesulfonamide (5m)**

White solid; Isolated yield 88% (0.26g); mp 175-177 °C; ¹H NMR (300 MHz, CDCl₃): δ 7.56 – 7.43 (m, 9H), 7.32 - 7.27 (m, 4H ), 7.22 – 7.19 (m, 1H), 7.17 – 7.15 (m, 1H), 7.10 – 7.07 (m, 4H), 4.94 (s, 2H), 2.33 (s, 3H); ¹³C NMR (75 MHz, CDCl₃): δ 168.0, 143.7, 142.0, 140.5, 136.2, 135.6, 132.5, 131.9, 130.2, 129.5, 128.9, 128.8, 128.6, 128.5, 126.6, 126.1, 124.7, 37.1, 21.3; MS (ESI) m/z [M+H]+: 546.1; Anal. Calcd for: C₂₈H₂₄BrN₃O₂S: C, 61.54; H, 4.43; N, 7.69%. Found C, 61.51; H, 4.45; N, 7.73%.

**N-(1-((E)-2-(2-chlorobenzylidene)-1-phenylhydrazinyl)-2-phenylethylidene)-4-methylbenzenesulfonamide (5n)**

White solid; Isolated yield 86% (0.30g); mp 169-171 °C; ¹H NMR (300 MHz, CDCl₃): δ 7.75 – 7.72 (m, 1H), 7.66 (s, 1H), 7.57 – 7.47 (m, 7H), 7.33 – 7.28 (m, 2H), 7.26 – 7.18 (m, 4H), 7.12 – 7.07 (m, 4H), 4.96 (s, 2H), 2.32 (s, 3H); ¹³C NMR (75 MHz, CDCl₃): δ 168.0, 142.0, 141.9, 140.5, 136.2, 135.6, 134.6, 131.2, 131.1, 130.2, 129.8, 129.6, 128.6, 128.5, 128.4, 127.3, 127.0, 126.6, 126.1, 37.1, 21.3; MS (ESI) m/z [M+H]+: 502.1; Anal. Calcd for: C₂₈H₂₄ClN₃O₂S: C, 66.99; H, 4.82; N, 8.37%. Found C, 67.04; H, 4.80; N, 8.34%.

**N-(1-((E)-2-(3-bromobenzylidene)-1-phenylhydrazinyl)-2-phenylethylidene)-4-methylbenzenesulfonamide (5o)**

White solid; Isolated yield 90% (0.26g); mp 188-190 °C; ¹H NMR (300 MHz, CDCl₃): δ 7.60 (s, 1H), 7.55 – 7.43 (m, 8H), 7.35 – 7.30 (m, 3H), 7.25 – 7.16 (m, 2H), 7.14 – 7.04 (m, 5H), 4.94 (s, 2H), 2.33 (s, 3H); ¹³C NMR (75 MHz, CDCl₃): δ 168.1, 143.1, 142.1, 140.0, 135.9, 135.6, 135.5, 133.1, 130.2, 129.6, 128.8, 128.6, 128.5, 126.6, 126.2, 126.0, 122.8, 37.2, 21.3; MS (ESI) m/z [M+H]+: 546.1; Anal. Calcd for: C₂₈H₂₄BrN₃O₂S: C, 61.54; H, 4.43; N, 7.69%. Found C, 61.58; H, 4.41; N, 7.71%.
**N-(1-((E)-2-(biphenyl-4-ylmethylene)-1 phenylhydrazinyl)-2-phenylethylidene)-4 methylbenzenesulfonamide (5p)**

White solid; Isolated yield 89% (0.26 g); mp 179-181 °C; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 7.59 – 7.51 (m, 11 H), 7.50 – 7.41 (m, 4 H), 7.38 – 7.18 (m, 6 H), 7.12 – 7.07 (m, 4 H), 4.99 (s, 2 H), 2.33 (s, 3 H); \(^{13}\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 168.0, 144.8, 143.2, 141.9, 140.6, 140.1, 136.4, 135.8, 132.5, 130.1, 129.4, 128.8, 128.7, 128.5, 128.1, 127.8, 127.3, 127.0, 126.5, 126.1, 37.0, 21.3; MS (ESI) m/z [M+H]\(^+\): 544.1; Anal. Calcd for: C\(_{34}\)H\(_{29}\)N\(_3\)O\(_2\)S: C, 75.11; H, 5.38; N, 7.73%. Found C, 75.07; H, 5.41; N, 7.77%.

**4-methyl-N-(2-phenyl-1-((E)-1-phenyl-2-(thiophen-2-ylmethylene)hydrazinyl)ethylidene)benzenesulfonamide (5q)**

White solid; Isolated yield 89% (0.37 g); mp 148-150 °C; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 7.59 (d, \(J\) = 7.2 Hz, 2 H) 7.56 – 7.46 (m, 5 H), 7.38 – 7.28 (m, 4 H), 7.23 – 7.18 (m, 1 H), 7.11 – 7.06 (m, 4 H), 7.01 – 6.95 (m, 2 H), 4.90 (s, 2 H), 2.34 (s, 3 H); \(^{13}\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 167.7, 141.8, 140.6, 139.4, 138.5, 136.2, 135.5, 130.7, 130.1, 129.4, 128.8, 128.5, 128.4, 127.4, 126.5, 126.0, 36.9, 21.3; MS (ESI) m/z [M+H]\(^+\): 473.9; Anal. Calcd for: C\(_{26}\)H\(_{23}\)N\(_3\)O\(_2\)S\(_2\): C, 65.94; H, 4.89; N, 8.87%. Found C, 65.90; H, 4.92; N, 8.85%.

**4-methyl-N-(2-phenyl-1-((E)-1-phenyl-2-(pyren-1-ylmethylene)hydrazinyl)ethylidene)benzenesulfonamide (5r)**

Yellow solid; Isolated yield 80% (0.2 g); mp 200-202 °C; \(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta\) 8.26 (d, \(J\) = 7.8 Hz, 2 H), 8.21 – 8.08 (m, 5 H), 8.04 – 7.94 (m, 3 H), 7.67 – 7.51 (m, 7 H), 7.35 – 7.19 (m, 6 H), 7.11 (d, \(J\) = 7.8 Hz, 2 H), 5.10 (s, 2 H), 2.35 (s, 3 H); \(^{13}\)C NMR (75 MHz, CDCl\(_3\)): \(\delta\) 168.0, 144.0, 141.9, 140.6, 137.0, 135.7, 132.7, 131.2, 130.4, 129.6, 129.4, 128.5, 128.8, 128.7, 128.6, 127.3, 126.6, 126.4, 126.2, 126.1, 126.0, 125.7, 125.3, 124.9, 124.8, 124.5, 121.8, 37.1, 21.3; MS (ESI) m/z [M+H]\(^+\): 592.2; Anal. Calcd for: C\(_{38}\)H\(_{29}\)N\(_3\)O\(_2\)S: C, 77.13; H, 4.94; N, 7.10%. Found C, 77.18; H, 4.91; N, 7.05%. 
**N-(1-((E)-2-(anthracen-9-ylmethylene)-1-phenylhydrazinyl)-2-p-tolythylidene)-4-methylbenzenesulfonamide (5s)**

Yellow solid; Isolated yield 81% (0.22g); mp 193-195 °C; ¹H NMR (300 MHz, CDCl₃): δ 8.43 (d, J = 5.4 Hz, 2H), 7.96 (d, J = 8.4 Hz, 2H), 7.88 (d, J = 8.7 Hz, 2H), 7.66 (t, J = 7.2 Hz, 2H), 7.59 – 7.51 (m, 3H), 7.46 – 7.28 (m, 11H), 7.10 (d, J = 8.1 Hz, 2H), 5.01 (s, 2H), 2.35 (s, 3H); ¹³C NMR (75 MHz, CDCl₃): δ 168.1, 145.0, 142.0, 140.6, 136.7, 135.4, 131.2, 130.5, 130.1, 130.0, 129.7, 128.9, 128.8, 128.6, 128.6, 128.4, 127.1, 126.5, 126.2, 125.3, 124.7, 124.3, 36.7, 21.3; MS (ESI) m/z [M+H]⁺: 582.2; Anal. Caled for: C₃₇H₃₁N₃O₂S: C, 76.39; H, 5.37; N, 7.22; O, 5.50; S, 5.51%. Found C, 76.46; H, 5.33; N, 7.26%.

**N-(1-((E)-2-(4-methoxybenzylidene)-1-phenylhydrazinyl)-2-p-tolythylidene)-4-methylbenzenesulfonamide (5t)**

White solid; Isolated yield 89% (0.33g); mp 182-184 °C; ¹H NMR (300 MHz, CDCl₃): δ 7.55 – 7.39 (m, 10H), 7.18 (s, 1H), 7.11 – 7.07 (m, 6H), 6.85 (d, J = 8.7 Hz, 1H), 4.91 (s, 2H), 3.82 (s, 3H), 2.33 (s, 3H), 2.29 (s, 3H); ¹³C NMR (75 MHz, CDCl₃): δ 168.1, 161.5, 145.0, 141.7, 140.7, 136.4, 136.0, 132.6, 130.1, 129.3, 129.2, 129.1, 128.7, 128.7, 126.2, 125.9, 114.5, 55.3, 36.5, 21.3, 21.0; MS (ESI) m/z [M+H]⁺: 512.2; Anal. Caled for: C₃₀H₂₉N₃O₃S: C, 70.43; H, 5.71; N, 8.21%. Found C, 70.46; H, 5.66; N, 8.26%.

**N-(1-((E)-2-(4-bromobenzylidene)-1-phenylhydrazinyl)-2-p-tolythylidene)-4-methylbenzenesulfonamide (5u)**

White solid; Isolated yield 87% (0.26g); mp 194-196 °C; ¹H NMR (300 MHz, CDCl₃): δ 7.56 – 7.44 (m, 7H), 7.38 – 7.31 (m, 4H), 7.15 (s, 1H), 7.11 – 7.07 (m, 6H), 4.90 (s, 2H), 2.33 (s, 3H), 2.29 (s, 3H); ¹³C NMR (75 MHz, CDCl₃): δ 168.2, 143.6, 141.9, 140.5, 136.2, 136.0, 132.6, 132.5, 131.9, 130.1, 129.5, 129.2, 128.8, 128.6, 128.5, 126.0, 124.6, 36.5, 21.3, 21.0; MS (ESI) m/z [M+H]⁺: 560.1; Anal. Caled for: C₃₉H₂₉BrN₃O₂S: C, 62.14; H, 4.68; N, 7.50%. Found C, 62.16; H, 4.65; N, 7.53%.
4-methyl-N-(1-((E)-2-(4-methylbenzylidene)-1-phenylhydrazinyl)-2-(4-pentylphenyl)ethylidene)benzenesulfonamide (5v)

White solid; Isolated yield 90% (0.41g); mp 140-142 °C; $^1$H NMR (300 MHz, CDCl$_3$): $\delta$ 7.54 – 7.49 (m, 3H), 7.44 (t, $J = 8.4$ Hz, 5H), 7.37 (d, $J = 8.1$ Hz, 2H), 7.21 (s, 1H), 7.15 (s, 1H), 7.12 – 7.08 (m, 5H), 7.06 (s, 1H), 4.92 (s, 2H), 2.53 (t, $J = 7.5$ Hz, 2H), 2.34 (s, 3H), 2.32 (s, 3H), 1.62 – 1.52 (m, 2H), 1.33 – 1.27 (m, 4H), 0.86 (t, $J = 6.6$ Hz, 3H); $^{13}$C NMR (75 MHz, CDCl$_3$): 168.2, 145.3, 141.7, 141.1, 140.8, 136.5, 132.8, 130.9, 130.0, 129.4, 129.3, 128.7, 128.5, 127.6, 127.0, 36.4, 35.5, 31.5, 31.0, 22.5, 21.4, 21.3, 14.0; MS (ESI) m/z [M+H]$^+$: 552.2; Anal. Calcd for: C$_{34}$H$_{37}$N$_3$O$_2$S: C, 74.01; H, 6.76; N, 7.62%. Found C, 74.04; H, 6.72; N, 7.65%.

N-(2-cyclopropyl-1-((E)-2-(4-methylbenzylidene)-1-phenylhydrazinyl)ethylidene)-4-methylbenzenesulfonamide (5w)

White solid; Isolated yield 87% (0.32g); mp 150-152 °C; $^1$H NMR (300 MHz, CDCl$_3$): $\delta$ 7.56 – 7.50 (m, 3H), 7.48 – 7.42 (m, 4H), 7.30 (s, 1H), 7.19 (s, 1H), 7.17 – 7.13 (m, 3H), 7.07 (d, $J = 7.5$ Hz, 2H), 3.53 (d, $J = 7.2$ Hz, 2H), 2.36 (s, 3H), 2.32 (s, 3H), 1.60 – 1.46 (m, 1H), 0.66 – 0.53(m, 4H); $^{13}$C NMR (75 MHz, CDCl$_3$): $\delta$ 170.4, 144.8, 141.7, 140.9, 140.8, 136.4, 130.8, 130.0, 129.5, 129.3, 128.8, 128.7, 125.8, 34.6, 21.4, 21.3, 9.2, 4.5; MS (ESI) m/z [M+H]$^+$: 446.1; Anal. Calcd for: C$_{26}$H$_{27}$N$_3$O$_2$S: C, 70.08; H, 6.11; N, 9.43%. Found C, 70.10; H, 6.14; N, 9.40%.
Copies of spectra for all Products
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5a

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5a
Mass spectrum of 5a
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5b

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5b
Mass spectrum of 5b
$^{1}H$ NMR (CDCl$_3$, 300 MHz) spectrum of $5c$

$^{13}C$ NMR (CDCl$_3$, 75 MHz) spectrum of $5c$
Mass spectrum of 5c
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5d

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5d
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5e

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5e
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5f

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5f
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5g

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5g
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5h

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5h
H NMR (CDCl$_3$, 300 MHz) spectrum of 5i

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5i
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5j

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5j
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5k

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5k
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5I

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5I
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5m

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5m
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5n

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5n
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5o

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5o
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5p

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5p
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5q

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5q
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5r

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5r
$^{1}H$ NMR (CDCl$_3$, 300 MHz) spectrum of $5s$

$^{13}C$ NMR (CDCl$_3$, 75 MHz) spectrum of $5s$
$^{1}H$ NMR (CDCl$_3$, 300 MHz) spectrum of 5t

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5t
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5u

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5u
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5v

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5v
$^1$H NMR (CDCl$_3$, 300 MHz) spectrum of 5w

$^{13}$C NMR (CDCl$_3$, 75 MHz) spectrum of 5w