Supporting Information For

Copper-Cobalt Coordination Polymers and Catalytic Applications on Borrowing Hydrogen Reactions†

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Contents

1. General methods and materials

All commercial reagents and solvents were obtained from the commercial provider and used without further purification. All the obtained products were characterized by ^{1}H-NMR, ^{13}C-NMR and referenced to DMSO-d_6 (2.50 ppm for ^{1}H, and 39.5 ppm for ^{13}C) or $CDCl_3$ (7.26 ppm for ^{1}H, and 77.1 ppm for ^{13}C) with tetramethylsilane as internal standard (0 ppm). ^{1}H-NMR and ^{13}C-NMR spectra were obtained on Varian 400 or 101 MHz respectively on Bruker Advance III HD 400 MHz spectrometer. Analytical thin layer chromatography (TLC) was performed using commercially prepared 100-400 mesh silica gel plates (SGF254). Flash column chromatography was performed on 230-430 mesh silica gel. SEM image and EDX spectra was performed on a HITACHI S-4800 field-emission scanning electron microscope. XPS data were recorded with electron energy analyzer (ESCALAB 250Xi, Thermo Fisher Co, USA). IR spectra were recorded on total reflection Fourier infrared spectrometer (NICOLET 6700). X-ray diffraction (XRD) were recorded on a Bruker D8 Advance X-ray diffractometer.

2. Synthesis of Cu-CIA and Cu-Co-CIA

2.1 The synthesis of (**1a**) and (**1b**)

1-(carboxymethyl)-1*H*-indole-5-carboxylic acid (CIA) synthesized according to known literature methods.[1] The mixture of the dissolved 1-(carboxymethyl)-1*H*-indole-5-carboxylic acid (CIA, 0.0219 g, 0.10 mmol), copper acetate (0.036 g, 0.20 mmol), DMF (3 mL), EtOH (2 mL) and water (1 mL) were stirred slowly for 30 minutes at room temperature. Then, the mixture was placed in a 15 ml Teflon-lined pressure vessel, heated for 24 hours at 120 °C. Subsequently, the resulting mixture was cooled to room temperature. The suspension was filtered and washed three times with anhydrous ethanol, and then dried at 80 ℃ for 6 h to afford Cu-CIA (**1a**) in 78% yield (0.0176 g). The mixture of the dissolved 1-(carboxymethyl)-1*H*-indole-5-carboxylic acid (CIA, 0.0219 g, 0.10 mmol), copper acetate (0.036 g, 0.20 mmol), cobalt nitrate hydrate (0.0291g, 0.10 mmol), DMF (3 mL), EtOH (2 mL) and water (1 mL) were stirred slowly for 30 minutes at room temperature. Then, the mixture was placed in a 15 ml Teflon-lined pressure vessel, heated for 24 hours at 120 °C. Subsequently, the resulting mixture was cooled to room temperature. The suspension was filtered and washed three times with anhydrous ethanol, and then dried at 80 ℃ for 6 h to afford Cu-Co-CIA (**1b**) in 84% yield (0.0189 g).

3. General procedure for 4

To a 25 mL reaction tube was added the catalyst Cu-Co-CIA (20 mg), Cs_2CO_3 (0.5 mmol), amine (1.0 mmol), alcohol (1.2 mmol). The mixture was heated at 90 °C for 12 h. After the reaction mixture was cooled to room temperature, the reaction mixture was concentrated by removing the solvent under vacuum to give a crude product. The crude product was purified by column chromatography, eluting with petroleum ether/ethyl acetate to afford the desired product **4**.

4. General procedure for 6

To a 25 mL reaction tube was added the catalyst Cu-Co-CIA (20 mg), Cs_2CO_3 (0.5 mmol), amine (1.0 mmol), alcohol (1.2 mmol). The mixture was heated at 90 °C for 12 h. After the reaction mixture was cooled to room temperature, the reaction mixture was concentrated by removing the solvent under vacuum to give a crude product. The crude product was purified by column chromatography, eluting with petroleum ether/ethyl acetate to afford the desired product **6**.

5. Characterizations of Cu-CIA and Cu-Co-CIA

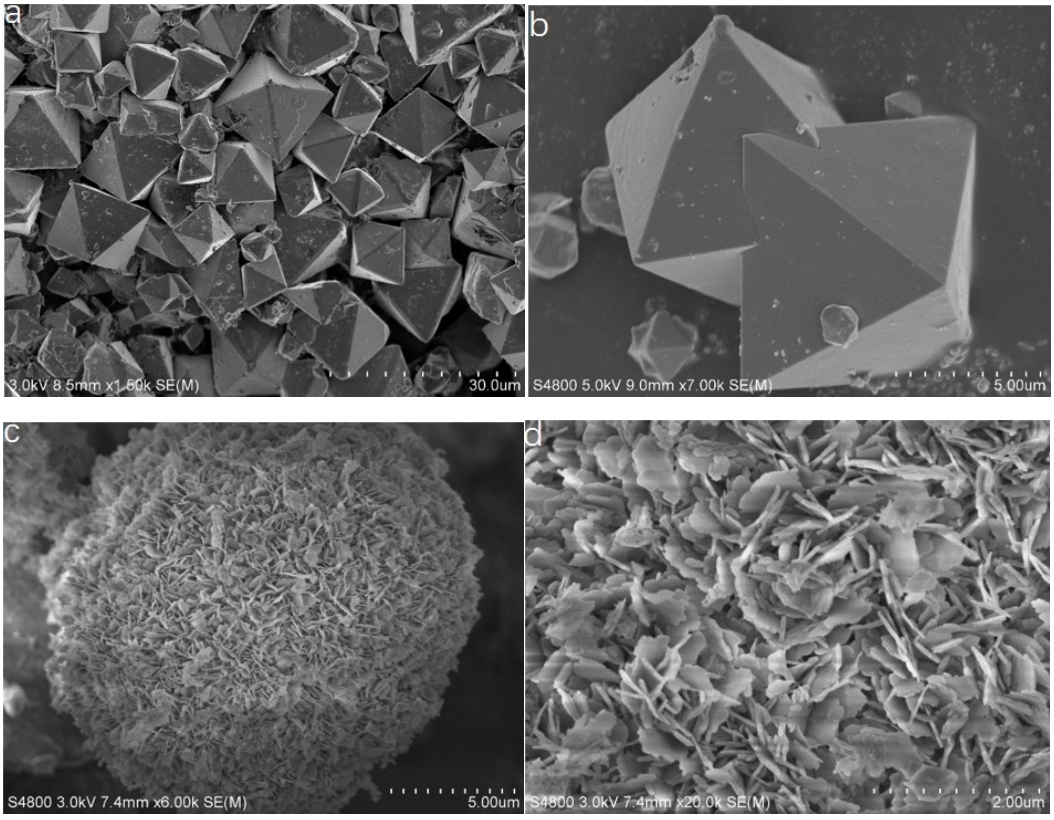


Fig. S1. (a) (b): SEM images of Cu-CIA; (c) (d): SEM images of Cu-Co-CIA.

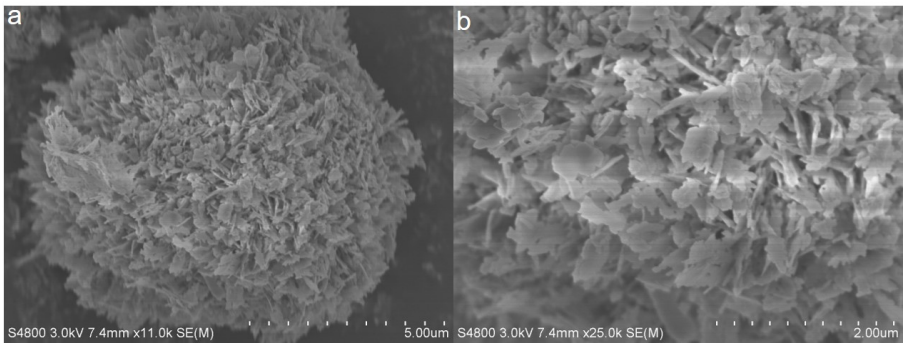


Fig.S2. (a) and (b) SEM images of Cu-Co-CIA after Six runs.

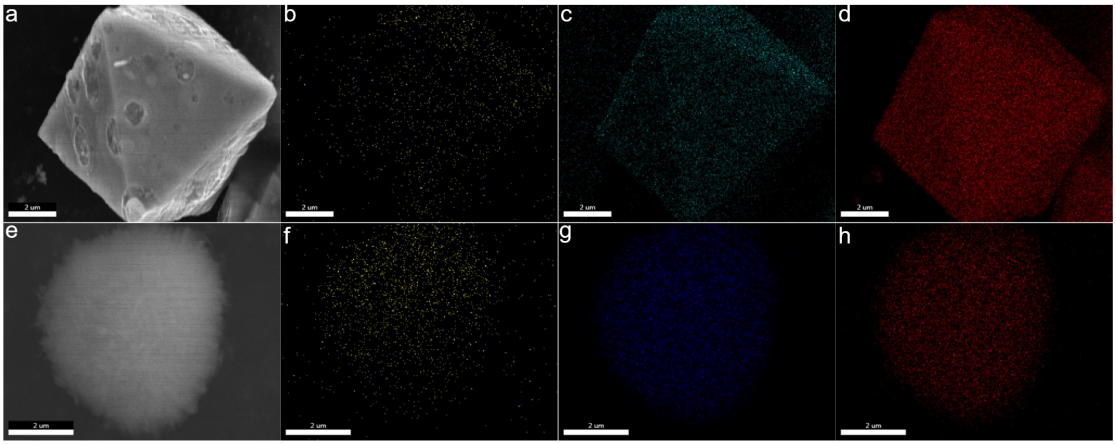


Fig.S3. SEM EDX image of Cu-CIA (1a) and Cu-Co-CIA (1b). The corresponding element mapping images of (a): Cu-CIA (1a), (b): N, (c): O, (d): Cu, (e): Cu-Co-CIA (1b), (f): N, (g): Co, (h): Cu.

Table.S1. Quantitative elemental composition of C, Cu N and O from the Cu-CIA XPS data.

Name	Start (BE)	Peak (BE)	End (BE)	Height (CPS)	FWHM (eV)	Area (P) CPS. (eV)	Area (N) TPP-2M	Atomic (%)
C1s	297.98	284.25	279.18	143372.01	1.49	282281.86	3956.88	80.01
Cu2p	964.98	931.96	925.18	6332.93	1.42	25790.02	24.22	0.49
N1s	409.98	399.55	392.18	1096.06	1.09	4285.66	38.72	0.78
O1s	544.98	531.79	525.18	60432.31	2.45	159565.27	925.59	18.72

Table.S2. Quantitative elemental composition of C, Co, Cu, N and O from the Cu-Co-CIA XPS data.

Name	Start (BE)	Peak (BE)	End (BE)	Height (CPS)	FWHM (eV)	Area (P) CPS. (eV)	Area (N) TPP-2M	Atomic (%)

C1s	297.98	284.35	279.18	149007.09	1.51	309718.07	4341.74	68.82
Co2p	811.98	780.84	771.18	23137.11	3.6	194895.76	223.62	3.54
Cu2p	964.98	934.26	925.18	6679.08	3.57	65172.22	61.38	0.97
N1s	409.98	399.68	392.18	1963.94	0.66	9524.96	86.06	1.36
O1s	544.98	531.48	525.18	106757.51	2.39	275209.88	1596.02	25.3

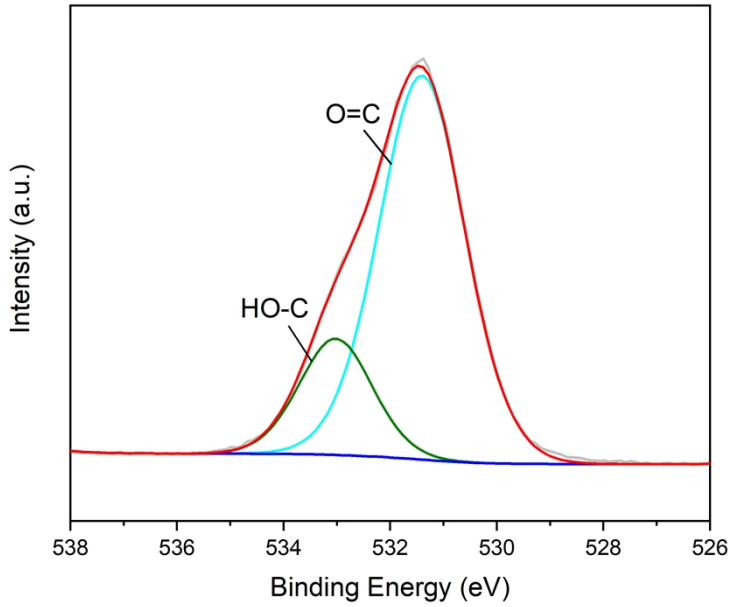
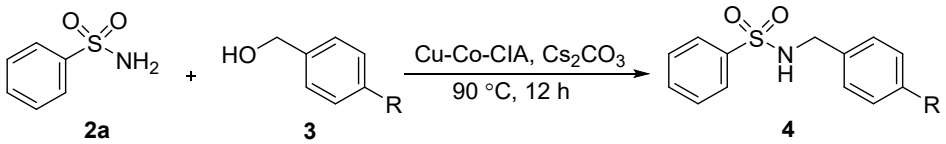


Fig.S4. high-resolution O 1s of Cu-Co-CIA.

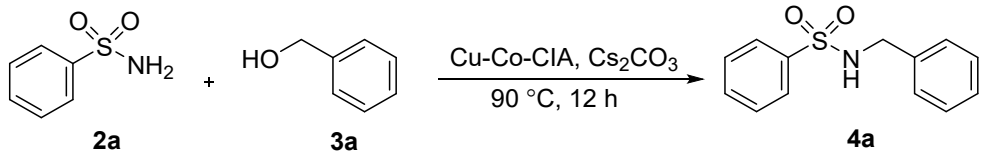
Hammett plot equation



Experimental procedure: To a 25 mL reaction tube was added the catalyst Cu-Co-CIA (20 mg), Cs_2CO_3 (0.5 mmol), **2a** (1.0 mmol), **3** (1.2 mmol). The mixture was heated at 90 °C for 1 h. After centrifugation and recycle the catalyst, the yield of product **4** was determined by GC.

R	OMe	Me	H	F	CF_3
Yield	23%	19%	15%	10%	8%

Time dependent product distribution plot



2a **3a** **4a**

Experimental procedure: To a 25 mL reaction tube was added the catalyst Cu-Co-CIA (20 mg), Cs_2CO_3 (0.5 mmol), **2a** (1.0 mmol), **3a** (1.2 mmol). The mixture was heated at 90 °C for 0.3 h，0.6 h, 2 h, 3 h, 6 h, 8 h and 12 h. After centrifugation and recycle the catalyst, the yield of products was determined by GC.

Time(h)	0.3	0.6	2	3	6	8	12
2a	85%	72%	48%	34%	28%	15%	8%
PhCHO	6%	14%	19%	13%	10%	4%	2%
4a	12%	18%	50%	61%	70%	82%	89%

Experimental procedure: To a 25 mL reaction tube was added the catalyst Cu-Co-CIA (20 mg), Cs_2CO_3 (0.5 mmol), **2a** (1.0 mmol), **3a** (1.2 mmol). The mixture was heated at 90 °C for 2 h. After the reaction mixture was cooled to room temperature, the reaction mixture was concentrated by removing the solvent under vacuum to give a crude product. The crude product was purified by column chromatography, eluting with petroleum ether/ethyl acetate to afford the desired product benzaldehyde in 19% yield (0.0242 g). The structure of key intermediate benzaldehyde was confirmed by ^{1}H-NMR and ^{13}C-NMR. ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 9.99 (s, 1H), 7.91 – 7.82 (m, 2H), 7.63 – 7.57 (m, 1H), 7.53 – 7.45 (m, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 192.45, 136.38, 134.47, 129.72, 128.99.

Reusability of the catalyst

To a 25 mL reaction tube was added the catalyst Cu-Co-CIA (20 mg), Cs_2CO_3 (0.5 mmol), **2a** (1.0 mmol), **3a** (1.2 mmol). The mixture was heated at 90 ℃ for 12 h. After the reaction mixture was cooled to room temperature, the catalyst was separated by centrifugation with ethyl acetate, washed with methanol and ethanol, dried in a vacuum, and reused for the next time.

6. Compounds characterization

N-Benzylbenzenesulfonamide 4a[6]

White solid. Mp.85.6-86.7 ℃. (89% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.89 – 7.81 (m, 2H), 7.62 – 7.53 (m, 1H), 7.52 – 7.45 (m, 2H), 7.23 (ddd, *J* = 5.3, 4.0, 2.5 Hz, 3H), 7.21 – 7.14 (m, 2H), 5.04 (t, *J* = 6.2 Hz, 1H), 4.12 (d, *J* = 6.2 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 139.94, 136.28, 132.70, 129.15, 128.68, 127.89, 127.63, 127.11, 47.25.

N-(4-Methylbenzyl)benzenesulfonamide 4b[2]

White solid. Mp.83.6-86.6 ℃. (87% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.88 – 7.83 (m, 2H), 7.57 (ddt, *J* = 8.3, 6.7, 1.3 Hz, 1H), 7.52 – 7.46 (m, 2H), 7.05 (s, 4H), 4.96 (t, *J* = 6.1 Hz, 1H), 4.07 (d, *J* = 6.1 Hz, 2H), 2.29 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 139.95, 137.76, 133.26, 132.77, 129.45, 129.23, 127.97, 127.22, 47.13, 21.20.

N-(3-Methylbenzyl)benzenesulfonamide 4c[3]

White solid. Mp.63.6-65.5 ℃. (85% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.88 – 7.81 (m, 2H), 7.59 – 7.51 (m, 1H), 7.50 – 7.40 (m, 2H), 7.12 (t, *J* = 7.8 Hz, 1H), 7.04 – 6.89 (m, 3H), 5.37 (t, *J* = 6.3 Hz, 1H), 4.07 (d, *J* = 6.3 Hz, 2H), 2.23 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 140.04, 138.44, 136.27, 132.76, 129.20, 128.73, 128.66, 128.64, 127.20, 125.00, 47.29, 21.37.

N-(2-Methylbenzyl)benzenesulfonamide 4d[3]

White solid. Mp.121.2-124.1 ℃. (82% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.88 – 7.81 (m, 2H), 7.61 – 7.53 (m, 1H), 7.53 – 7.43 (m, 2H), 7.18 – 7.04 (m, 4H), 4.96 (t, *J* = 6.0 Hz, 1H), 4.08 (d, *J* = 6.0 Hz, 2H), 2.21 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 139.68, 136.77, 133.96, 132.84, 130.68, 129.24, 129.02, 128.33, 127.21, 126.28, 45.46, 18.92.

N-(4-Chlorobenzyl)benzenesulfonamide 4e[2]

White solid. Mp.112.1-114.3 ℃. (84% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.86 – 7.79 (m, 2H), 7.61 – 7.55 (m, 1H), 7.52 – 7.45 (m, 2H), 7.25 – 7.16 (m, 2H), 7.14 – 7.06 (m, 2H), 5.09 (t, *J* = 6.3 Hz, 1H), 4.09 (d, *J* = 6.3 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 139.83, 134.87, 133.83, 132.94, 129.31, 128.90, 128.40, 127.15, 46.64.

N-(2-Chlorobenzyl)benzenesulfonamide 4f[2]

White solid. Mp.88.4-89.9 ℃. (80% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.86 – 7.74 (m, 2H), 7.55 – 7.48 (m, 1H), 7.46 – 7.39 (m, 2H), 7.30 – 7.20 (m, 2H), 7.18 – 7.07 (m, 2H), 5.21 (t, *J* =

6.5 Hz, 1H), 4.25 (d, *J* = 6.5 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 139.97, 133.83, 133.44, 132.76, 130.37, 129.59, 129.45, 129.14, 127.17, 127.09, 45.27.

N-(4-Methoxybenzyl)benzenesulfonamide 4g[2]

White solid. Mp.49.5-51.8 ℃. (88% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.86 – 7.79 (m, 2H), 7.60 – 7.51 (m, 1H), 7.46 (ddt, *J* = 8.3, 6.7, 1.3 Hz, 2H), 7.10 – 7.01 (m, 2H), 6.77 – 6.70 (m, 2H), 5.19 (t, *J* = 6.1 Hz, 1H), 4.03 (d, *J* = 6.1 Hz, 2H), 3.72 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 159.27, 139.97, 132.76, 129.38, 129.23, 128.39, 127.19, 114.09, 55.38, 46.82.

N-(4-(Trifluoromethyl)benzyl)benzenesulfonamide 4h[5]

White solid. Mp.143.2-144.8 ℃. (78% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.86 – 7.79 (m, 2H), 7.60 – 7.54 (m, 1H), 7.47 (ddt, *J* = 8.2, 6.7, 1.5 Hz, 4H), 7.33 – 7.27 (m, 2H), 5.29 (t, *J* = 6.4 Hz, 1H), 4.19 (d, *J* = 6.4 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 140.44, 139.78, 133.02, 130.15 (q, *J* = 32.5 Hz), 129.32, 128.15, 128.09 (q, *J* = 271.0 Hz), 127.12, 125.66 (q, *J* = 3.8 Hz), 46.74.

N-(4-Fluorobenzyl)benzenesulfonamide 4i[2]

White solid. Mp.103.5-104.7 ℃. (85% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.88 – 7.79 (m, 2H), 7.57 (ddt, *J* = 8.3, 6.7, 1.3 Hz, 1H), 7.52 – 7.44 (m, 2H), 7.18 – 7.10 (m, 2H), 6.96 – 6.87 (m, 2H), 5.09 (t, *J* = 6.2 Hz, 1H), 4.11 – 4.07 (m, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 162.42 (d, *J* = 246.5 Hz), 139.88, 132.91, 132.11 (d, *J* = 3.3 Hz), 129.73 (d, *J* = 8.2 Hz), 129.28, 127.16, 115.64 (d, *J* = 21.6 Hz), 46.62.

N-(3-Fluorobenzyl)benzenesulfonamide 4j[4]

White solid. Mp.78.1-79.1 ℃. (83% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.87 – 7.78 (m, 2H), 7.59 – 7.53 (m, 1H), 7.51 – 7.43 (m, 2H), 7.23 – 7.15 (m, 1H), 6.95 (ddt, *J* = 7.0, 1.4, 0.8 Hz, 1H), 6.93 – 6.84 (m, 2H), 5.37 (t, *J* = 6.4 Hz, 1H), 4.11 (d, *J* = 6.4 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 162.89 (d, *J* = 246.5 Hz), 139.81, 138.98 (d, *J* = 7.3 Hz), 132.95, 130.29 (d, *J* = 8.2 Hz), 129.30, 127.14, 123.44 (d, *J* = 2.9 Hz), 114.94, 114.72 (d, *J* = 2.4 Hz), 46.70 (d, *J* = 2.0 Hz).

N-(4-Bromobenzyl)benzenesulfonamide 4k[3]

White solid. Mp.111.1-112.2 ℃. (82% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.85 – 7.78 (m, 2H), 7.61 – 7.54 (m, 1H), 7.52 – 7.45 (m, 2H), 7.38 – 7.31 (m, 2H), 7.05 (d, *J* = 8.4 Hz, 2H), 5.17 (t, *J* = 6.4 Hz, 1H), 4.07 (d, *J* = 6.3 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 139.80, 135.42, 132.94, 131.84, 129.65, 129.31, 127.14, 121.92, 46.67.

N-(Naphthalen-2-ylmethyl)benzenesulfonamide 4l

White solid. Mp.127.8-129.7 ℃. (86% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.90 – 7.83 (m, 2H), 7.80 – 7.66 (m, 3H), 7.59 (d, *J* = 1.8 Hz, 1H), 7.57 – 7.51 (m, 1H), 7.49 – 7.42 (m, 4H), 7.27 (dd, *J* = 8.5, 1.8 Hz, 1H), 5.02 (t, *J* = 6.3 Hz, 1H), 4.28 (d, *J* = 6.2 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 139.99, 133.68, 133.25, 132.95, 132.82, 129.24, 128.67, 127.87, 127.77, 127.21, 126.82, 126.47, 126.29, 125.73, 47.55.

N-(Thiophen-3-ylmethyl)benzenesulfonamide 4m

Green oil, (76% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.88 – 7.80 (m, 2H), 7.62 – 7.53 (m, 1H), 7.49 (t, *J* = 7.3 Hz, 2H), 7.20 (dd, *J* = 5.0, 3.0 Hz, 1H), 7.10 – 6.98 (m, 1H), 6.89 – 6.82 (m, 1H), 4.96 (t, *J* = 6.2 Hz, 1H), 4.16 (d, *J* = 6.1 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 139.97, 137.16, 132.83, 129.24, 127.17, 127.12, 126.67, 123.03, 42.53.

N-(Benzo[d][1,3]dioxol-5-ylmethyl)benzenesulfonamide 4n[7]

White solid. Mp.70.2-72.4 ℃. (85% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.86 – 7.80 (m, 2H), 7.58 – 7.53 (m, 1H), 7.51 – 7.44 (m, 2H), 6.67 – 6.57 (m, 3H), 5.88 (s, 2H), 5.05 (t, *J* = 6.1 Hz, 1H), 4.01 (d, *J* = 6.0 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 147.96, 147.35, 140.02, 132.78, 130.09, 129.22, 127.18, 121.45, 108.55, 108.30, 101.22, 47.20.

N-(3,5-Bis(trifluoromethyl)benzyl)benzenesulfonamide 4o[5]

White solid. Mp.108.3-109.5 ℃. (77% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.84 – 7.77 (m, 2H), 7.71 (s, 1H), 7.63 (s, 2H), 7.56 (t, *J* = 7.4 Hz, 1H), 7.46 (t, *J* = 7.7 Hz, 2H), 5.46 (t, *J* = 6.5 Hz, 1H), 4.29 (d, *J* = 6.5 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 139.69, 139.14, 133.23, 132.06 (q, *J* = 33.4 Hz), 129.41, 127.97, 127.06, 124.45 (q, *J* = 272.1 Hz), 121.96 (q, *J* = 3.8 Hz), 46.35.

N-(3,5-Dimethoxybenzyl)benzenesulfonamide 4p

White solid. Mp.80.3-81.6 ℃. (82% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.87 – 7.81 (m, 2H), 7.57 – 7.52 (m, 1H), 7.51 – 7.46 (m, 2H), 6.29 (s, 3H), 4.05 (d, *J* = 6.2 Hz, 2H), 3.68 (s, 6H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 161.04, 139.99, 138.60, 132.82, 129.24, 127.19, 126.45, 105.66, 100.07, 55.43, 47.44.

N-Benzyl-4-methylbenzenesulfonamide 4q[6]

White solid. Mp.113.1-114.2 ℃. (93% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.77 – 7.70 (m, 2H), 7.35 – 7.21 (m, 5H), 7.21 – 7.15 (m, 2H), 5.05 (t, *J* = 6.3 Hz, 1H), 4.08 (d, *J* = 6.3 Hz, 2H),

2.42 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 143.62, 136.86, 136.45, 129.86, 128.75, 127.99, 127.93, 127.29, 47.30, 21.67.

4-Methyl-N-(4-methylbenzyl)benzenesulfonamide 4r[6]

White solid. Mp.90.3-92.4 ℃. (86% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.76 – 7.71 (m, 2H), 7.31 – 7.26 (m, 2H), 7.06 (s, 4H), 4.85 (t, *J* = 6.1 Hz, 1H), 4.04 (d, *J* = 6.2 Hz, 2H), 2.43 (s, 3H), 2.29 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 143.58, 137.73, 136.88, 133.34, 129.84, 129.44, 127.98, 127.30, 47.11, 21.67, 21.21.

4-Methyl-N-(3-methylbenzyl)benzenesulfonamide 4s[8]

White solid. Mp.65.1-66.9 ℃. (85% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.78 – 7.70 (m, 2H), 7.31 – 7.24 (m, 2H), 7.14 (t, *J* = 7.8 Hz, 1H), 7.08 – 7.01 (m, 1H), 6.96 (ddt, *J* = 5.7, 3.1, 1.0 Hz, 2H), 4.88 (t, *J* = 6.2 Hz, 1H), 4.06 (d, *J* = 6.2 Hz, 2H), 2.42 (s, 3H), 2.26 (d, *J* = 0.8 Hz, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 143.55, 138.47, 137.02, 136.31, 129.80, 128.72, 128.67, 128.65, 127.30, 124.99, 47.32, 21.62, 21.34.

4-Methyl-N-(2-methylbenzyl)benzenesulfonamide 4t[8]

White solid. Mp.117.4-118.7 ℃. (82% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.78 – 7.71 (m, 2H), 7.33 – 7.26 (m, 2H), 7.19 – 7.05 (m, 4H), 4.72 (t, *J* = 6.0 Hz, 1H), 4.06 (d, *J* = 6.0 Hz, 2H), 2.43 (s, 3H), 2.23 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 143.61, 136.80, 136.73, 134.05, 130.67, 129.82, 128.98, 128.29, 127.30, 126.27, 45.46, 21.65, 18.89.

N-(4-Chlorobenzyl)-4-methylbenzenesulfonamide 4u[6]

White solid. Mp.105.7-107.4 ℃. (91% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.72 – 7.66 (m, 2H), 7.30 – 7.22 (m, 2H), 7.21 – 7.16 (m, 2H), 7.14 – 7.07 (m, 2H), 5.23 (t, *J* = 6.4 Hz, 1H), 4.05 (d, *J* = 6.4 Hz, 2H), 2.41 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 143.78, 136.76, 135.03, 133.69, 129.88, 129.34, 128.82, 127.22, 46.58, 21.67.

N-(2-Chlorobenzyl)-4-methylbenzenesulfonamide 4v[6]

White solid. Mp.67.7-68.7 ℃. (86% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.72 – 7.66 (m, 2H), 7.31 – 7.20 (m, 4H), 7.19 – 7.11 (m, 2H), 5.11 (t, *J* = 6.5 Hz, 1H), 4.22 (d, *J* = 6.5 Hz, 2H), 2.39 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 143.55, 137.01, 134.04, 133.44, 130.33, 129.73, 129.55, 129.33, 127.18, 127.15, 45.20, 21.61.

N-(4-Methoxybenzyl)-4-methylbenzenesulfonamide 4w[6]

White solid. Mp.117.5-118.8℃. (89% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.77 – 7.70 (m, 2H), 7.28 (d, *J* = 8.0 Hz, 2H), 7.08 (d, *J* = 8.7 Hz, 2H), 6.77 (d, *J* = 8.6 Hz, 2H), 4.76 (d, *J* = 6.3 Hz, 1H), 4.03 (d, *J* = 5.4 Hz, 2H), 3.75 (s, 3H), 2.42 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 159.37, 143.55, 136.99, 129.82, 129.36, 128.40, 127.28, 114.14, 55.37, 46.86, 21.63.

4-Methyl-N-(4-(trifluoromethyl)benzyl)benzenesulfonamide 4x[6]

White solid. Mp.136.0-137.6 ℃. (81% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.71 – 7.66 (m, 2H), 7.49 – 7.44 (m, 2H), 7.32 – 7.27 (m, 2H), 7.26 – 7.21 (m, 2H), 5.40 (t, *J* = 6.5 Hz, 1H), 4.16 (d, *J* = 6.5 Hz, 2H), 2.40 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 143.85, 140.61, 136.82, 130.36 (q, *J* = 32.3 Hz), 129.84, 128.17, 127.19, 125.57 (q, *J* = 3.6 Hz), 125.42(q, *J* = 271.1 Hz), 46.70, 21.54.

N-(3-Bromobenzyl)-4-methylbenzenesulfonamide 4y[9]

White solid. Mp.76.2-78.4 ℃. (83% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.73 – 7.67 (m, 2H), 7.33 (dt, *J* = 6.4, 2.3 Hz, 1H), 7.29 – 7.23 (m, 3H), 7.14 – 7.07 (m, 2H), 5.15 (t, *J* = 6.4 Hz, 1H), 4.07 (d, *J* = 6.4 Hz, 2H), 2.41 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 143.81, 138.80, 136.85, 130.95, 130.93, 130.27, 129.90, 127.21, 126.54, 122.70, 46.63, 21.65.

N-(4-Bromobenzyl)-4-methylbenzenesulfonamide 4z[6]

White solid. Mp.115.4-116.9 ℃. (88% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.74 – 7.65 (m, 2H), 7.40 – 7.32 (m, 2H), 7.29 – 7.24 (m, 2H), 7.09 – 7.02 (m, 2H), 5.02 (t, *J* = 6.4 Hz, 1H), 4.05 (d, *J* = 6.4 Hz, 2H), 2.42 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 143.79, 136.86, 135.52, 131.82, 129.87, 129.65, 127.23, 121.88, 46.67, 21.64.

N-(4-Fluorobenzyl)-4-methylbenzenesulfonamide 4aa[6]

White solid. Mp.99.1-100.0 ℃. (82% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.75 – 7.68 (m, 2H), 7.27 (dt, *J* = 7.9, 0.7 Hz, 2H), 7.18 – 7.11 (m, 2H), 6.96 – 6.88 (m, 2H), 5.09 – 4.95 (m, 1H), 4.06 (d, *J* = 5.7 Hz, 2H), 2.42 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 162.43 (d, *J* = 246.3 Hz), 143.71, 136.91, 132.25 (d, *J* = 3.2 Hz), 129.85, 129.72 (d, *J* = 8.3 Hz), 127.23, 115.59 (d, *J* = 21.6 Hz), 46.60, 21.62.

4-Methyl-N-(naphthalen-2-ylmethyl)benzenesulfonamide 4ab[6]

White solid. Mp.132.3-133.7 ℃. (80% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.81 – 7.66 (m, 5H), 7.58 (d, *J* = 1.8 Hz, 1H), 7.45 (dt, *J* = 6.2, 3.4 Hz, 2H), 7.31 – 7.20 (m, 3H), 5.00 (t, *J* = 6.3 Hz,

1H), 4.26 (d, *J* = 6.3 Hz, 2H), 2.38 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 143.63, 137.01, 133.76, 133.27, 132.95, 129.81, 128.63, 127.87, 127.75, 127.28, 126.80, 126.42, 126.24, 125.78, 47.53, 21.59.

N-Benzyl-4-methoxybenzenesulfonamide 4ac[6]

White solid. Mp.106.6-107.8 ℃. (87% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.82 – 7.74 (m, 2H), 7.29 – 7.21 (m, 3H), 7.18 (dd, *J* = 7.6, 2.0 Hz, 2H), 6.97 – 6.92 (m, 2H), 4.85 (t, *J* = 6.2 Hz, 1H), ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 163.02, 136.42, 131.48, 129.41, 128.78, 127.98, 114.37, 55.74, 47.31.

N-Benzyl-4-fluorobenzenesulfonamide 4ad[6]

White solid. Mp.95.0-96.3 ℃. (84% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.87 – 7.79 (m, 2H), 7.29 – 7.22 (m, 3H), 7.22 – 7.10 (m, 4H), 5.00 (t, *J* = 6.2 Hz, 1H), 4.13 (d, *J* = 6.2 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 165.15 (d, *J* = 254.8 Hz), 136.11, 136.08, 129.94 (d, *J* = 9.3 Hz), 128.83, 128.10, 127.97, 116.41 (d, *J* = 22.6 Hz), 47.34.

N-Benzyl-4-bromobenzenesulfonamide 4ae[6]

White solid. Mp.115.8-116.8 ℃. (86% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.71 – 7.64 (m, 2H), 7.63 – 7.56 (m, 2H), 7.30 – 7.21 (m, 3H), 7.20 – 7.13 (m, 2H), 5.07 (t, *J* = 6.2 Hz, 1H), 4.12 (d, *J* = 6.2 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 139.13, 136.02, 132.47, 128.84, 128.76, 128.12, 127.98, 127.73, 47.36.

N-Benzyl-4-chlorobenzenesulfonamide 4af[9]

White solid. Mp.108.4-109.6 ℃. (85% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.78 – 7.69 (m, 2H), 7.44 – 7.36 (m, 2H), 7.27 – 7.20 (m, 3H), 7.19 – 7.12 (m, 2H), 5.31 (t, *J* = 6.2 Hz, 1H), 4.11 (d, *J* = 6.3 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 139.20, 138.59, 136.11, 129.46, 128.80, 128.66, 128.05, 127.99, 47.31.

N-Benzyl-4-(trifluoromethyl)benzenesulfonamide 4ag[6]

White solid. Mp.126.0-127.7 ℃. (79% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.93 (d, *J* = 8.2 Hz, 2H), 7.71 (d, *J* = 8.2 Hz, 2H), 7.27 – 7.21 (m, 3H), 7.15 (dd, *J* = 6.7, 2.9 Hz, 2H), 5.17 (t, *J* = 6.2 Hz, 1H), 4.18 (d, *J* = 6.1 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 143.69, 135.72, 134.33 (q, J = 33.0 Hz), 128.76, 128.10, 127.89, 127.60, 127.30 (q, J = 271.3 Hz), 126.24 (q, J = 3.8 Hz), 47.33.

N-Benzylbenzamide 6a[10]

White solid. Mp.104.7-107.2 ℃. (94% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.81 – 7.76 (m, 2H), 7.51 – 7.45 (m, 1H), 7.43 – 7.37 (m, 2H), 7.33 (d, *J* = 4.0 Hz, 4H), 7.30 – 7.25 (m, 1H), 6.64 (s, 1H), 4.61 (d, *J* = 5.7 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 167.56, 138.31, 134.43, 131.68, 128.89, 128.70, 128.01, 127.71, 127.11, 44.19.

N-(4-Methylbenzyl)benzamide 6b[10]

White solid. Mp.135.2-136.6 ℃. (92% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.81 – 7.72 (m, 2H), 7.50 – 7.43 (m, 1H), 7.42 – 7.35 (m, 2H), 7.22 (d, *J* = 7.9 Hz, 2H), 7.13 (d, *J* = 7.8 Hz, 2H), 6.62 (s, 1H), 4.56 (d, *J* = 5.6 Hz, 2H), 2.33 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 167.41, 137.28, 135.24, 134.48, 131.49, 129.44, 128.56, 127.94, 127.03, 43.89, 21.14.

N-(3-Methylbenzyl)benzamide 6c[10]

White solid. Mp.125.4-127.7 ℃. (89% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.81 – 7.76 (m, 2H), 7.52 – 7.46 (m, 1H), 7.44 – 7.39 (m, 2H), 7.26 – 7.23 (m, 1H), 7.17 – 7.08 (m, 3H), 6.45 (s, 1H), 4.60 (d, *J* = 5.7 Hz, 2H), 2.34 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 167.42, 138.65, 138.16, 134.50, 131.65, 128.82, 128.70, 128.50, 127.07, 125.08, 44.24, 21.49.

N-(2-Methylbenzyl)benzamide 6d[10]

White solid. Mp.108.9-110.2 ℃. (85% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.81 – 7.73 (m, 2H), 7.49 – 7.44 (m, 1H), 7.38 (dd, *J* = 8.2, 6.7 Hz, 2H), 7.27 (d, *J* = 7.0 Hz, 1H), 7.22 – 7.11 (m, 3H), 6.54 – 6.40 (m, 1H), 4.59 (d, *J* = 5.4 Hz, 2H), 2.34 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 167.32, 136.57, 135.85, 134.40, 131.53, 130.62, 128.63, 128.59, 127.87, 127.02, 126.29, 42.31, 19.08.

N-(4-Methoxybenzyl)benzamide 6e[10]

White solid. Mp.94.4-96.5 ℃. (90% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.80 – 7.74 (m, 2H), 7.47 – 7.42 (m, 1H), 7.39 – 7.35 (m, 2H), 7.27 – 7.20 (m, 2H), 6.88 – 6.81 (m, 2H), 6.73 (d, *J* = 5.6 Hz, 1H), 4.52 (d, *J* = 5.6 Hz, 2H), 3.76 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 167.39, 159.06, 134.48, 131.47, 130.42, 129.26, 128.54, 127.04, 114.12, 55.32, 43.57.

N-(4-Chlorobenzyl)benzamide 6f[10]

White solid. Mp.137.6-139.3 ℃. (88% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.81 – 7.75 (m, 2H), 7.53 – 7.47 (m, 1H), 7.44 – 7.38 (m, 2H), 7.31 – 7.22 (m, 4H), 6.68 (s, 1H), 4.57 (d, *J* = 5.8

Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 167.49, 136.86, 134.19, 133.36, 131.68, 129.18, 128.87, 128.63, 127.00, 43.36.

N-(3-Chlorobenzyl)benzamide 6g[10]

White solid. Mp.110.0-111.2 ℃. (84% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.81 – 7.74 (m, 2H), 7.51 – 7.44 (m, 1H), 7.42 – 7.35 (m, 2H), 7.28 (q, *J* = 1.1 Hz, 1H), 7.24 – 7.14 (m, 3H), 6.89 (s, 1H), 4.55 (d, *J* = 5.8 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 167.69, 140.50, 134.60, 134.15, 131.80, 130.08, 128.71, 127.87, 127.75, 127.15, 125.97, 43.50.

N-(2-Bromobenzyl)benzamide 6h[10]

White solid. Mp.95.5-97.4 ℃. (81% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.81 – 7.73 (m, 2H), 7.54 (d, *J* = 8.0 Hz, 1H), 7.50 – 7.36 (m, 4H), 7.28 – 7.23 (m, 1H), 7.17 – 7.09 (m, 1H), 6.84 (s, 1H), 4.67 (dd, *J* = 6.1, 1.9 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 167.51, 137.33, 134.30, 132.92, 131.73, 130.53, 129.35, 128.70, 127.88, 127.12, 123.86, 44.42.

N-(4-Fluorobenzyl)benzamide 6i[10]

White solid. Mp.112.1-113.0 ℃. (87% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.79 – 7.65 (m, 2H), 7.43 – 7.38 (m, 1H), 7.31 (dd, *J* = 8.3, 6.8 Hz, 2H), 7.24 – 7.16 (m, 2H), 7.01 – 6.83 (m, 2H), 6.70 (s, 1H), 4.48 (d, *J* = 5.8 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 167.49, 162.21 (d, *J* = 245.7 Hz), 134.26, 134.14 (d, *J* = 3.2 Hz), 131.62, 129.50 (d, *J* = 8.1 Hz), 128.59, 127.02, 115.54 (d, *J* = 21.5 Hz), 43.31.

N-(4-(Trifluoromethyl)benzyl)benzamide 6j[10]

White solid. Mp.138.8-140.7 ℃. (83% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.81 – 7.75 (m, 2H), 7.54 (d, *J* = 7.8 Hz, 2H), 7.52 – 7.46 (m, 1H), 7.39 (td, *J* = 7.0, 1.2 Hz, 4H), 6.91 (t, *J* = 5.9 Hz, 1H), 4.63 (d, *J* = 5.8 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 167.78, 142.53, 134.07, 131.89, 129.81 (q, *J* = 32.4 Hz), 128.74, 128.23 (q, *J* = 271.3 Hz), 127.97, 127.12, 125.71 (q, *J* = 3.8 Hz), 43.55.

N-(Thiophen-2-ylmethyl)benzamide 6k[10]

White solid. Mp.119.6-121.5 ℃. (85% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.80 – 7.74 (m, 2H), 7.52 – 7.45 (m, 1H), 7.44 – 7.37 (m, 2H), 7.22 (dd, *J* = 5.1, 1.2 Hz, 1H), 7.01 (dt, *J* = 3.0, 1.1 Hz, 1H), 6.95 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.62 (s, 1H), 4.79 (dd, *J* = 5.6, 0.8 Hz, 2H). ^{13}C NMR (101

MHz, CHLOROFORM-D) δ 167.29, 140.91, 134.23, 131.75, 128.69, 127.13, 127.06, 126.34, 125.45, 38.92.

N-(Naphthalen-2-ylmethyl)benzamide 6l[10]

White solid. Mp.145.3-146.8 ℃. (78% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.85 – 7.71 (m, 6H), 7.52 – 7.36 (m, 6H), 6.71 (s, 1H), 4.76 (d, *J* = 5.7 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 167.57, 135.78, 134.45, 133.48, 132.90, 131.69, 128.71, 127.86, 127.81, 127.14, 126.61, 126.42, 126.08, 44.33.

N-Benzyl-4-methoxybenzamide 6m[10]

White solid. Mp.128.4-130.5 ℃. (89% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.71 – 7.64 (m, 2H), 7.26 (d, *J* = 4.3 Hz, 4H), 7.21 – 7.17 (m, 1H), 6.84 – 6.77 (m, 2H), 6.42 (s, 1H), 4.53 (d, *J* = 5.7 Hz, 2H), 3.75 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 166.93, 162.23, 138.47, 128.82, 128.75, 127.90, 127.53, 126.67, 113.77, 55.42, 44.06.

4-Methoxy-N-(4-methylbenzyl)benzamide 6n[10]

White solid. Mp.142.6-146.7 ℃. (87% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.74 (d, *J* = 8.8 Hz, 2H), 7.25 (d, *J* = 1.2 Hz, 2H), 7.15 (d, *J* = 7.9 Hz, 2H), 6.90 (d, *J* = 8.8 Hz, 2H), 6.26 (s, 1H), 4.58 (d, *J* = 5.5 Hz, 2H), 3.83 (s, 3H), 2.33 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 166.92, 162.27, 137.39, 135.44, 129.52, 128.86, 128.06, 126.79, 113.83, 55.50, 43.95, 21.22.

4-Methoxy-N-(3-methylbenzyl)benzamide 6o[10]

White solid. Mp.140.4-142.2 ℃. (83% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.78 – 7.72 (m, 2H), 7.27 – 7.21 (m, 1H), 7.17 – 7.08 (m, 3H), 6.92 – 6.87 (m, 2H), 6.37 (s, 1H), 4.58 (d, *J* = 5.6 Hz, 2H), 3.83 (s, 3H), 2.33 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 166.94, 162.29, 138.60, 138.38, 128.89, 128.81, 128.77, 128.42, 126.74, 125.07, 113.84, 55.51, 44.16, 21.50.

4-Methoxy-N-(2-methylbenzyl)benzamide 6p[10]

White solid. Mp.111.1-112.2 ℃. (80% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.69 – 7.62 (m, 2H), 7.21 – 7.17 (m, 1H), 7.14 – 7.06 (m, 3H), 6.82 – 6.77 (m, 2H), 6.27 (d, *J* = 5.5 Hz, 1H), 4.50 (d, *J* = 5.4 Hz, 2H), 3.73 (s, 3H), 2.26 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 166.82, 162.21, 136.57, 136.06, 130.58, 128.81, 127.78, 126.66, 126.25, 113.76, 55.41, 42.23, 19.06.

N-(4-Chlorobenzyl)-4-methoxybenzamide 6q[10]

White solid. Mp.150.8-152.0 ℃. (86% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.79 – 7.63 (m, 2H), 7.31 – 7.24 (m, 4H), 6.94 – 6.82 (m, 2H), 6.45 (s, 1H), 4.57 (d, *J* = 5.8 Hz, 2H), 3.83 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 167.00, 162.43, 137.08, 133.43, 129.32, 128.97, 128.88, 126.45, 113.91, 55.53, 43.42.

N-Benzyl-4-methylbenzamide 6r[10]

White solid. Mp.134.7-136.8 ℃. (93% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.71 – 7.66 (m, 2H), 7.34 (d, *J* = 4.4 Hz, 4H), 7.31 – 7.25 (m, 1H), 7.24 – 7.18 (m, 2H), 6.43 (s, 1H), 4.63 (d, *J* = 5.7 Hz, 2H), 2.38 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 167.40, 142.10, 138.40, 131.59, 129.35, 128.88, 128.03, 127.69, 127.06, 44.17, 21.55.

N-Benzyl-4-chlorobenzamide 6s[10]

White solid. Mp.165.5-166.9 ℃. (91% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.68 – 7.61 (m, 2H), 7.35 – 7.21 (m, 7H), 6.40 (s, 1H), 4.54 (d, *J* = 5.6 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 166.31, 137.96, 137.82, 132.75, 128.86, 128.43, 127.95, 127.75, 44.25.

N-Benzyl-3-chlorobenzamide 6t[11]

White solid. Mp.91.4-92.9 ℃. (88% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.77 (t, *J* = 1.9 Hz, 1H), 7.64 (ddd, *J* = 7.7, 1.7, 1.1 Hz, 1H), 7.46 (ddd, *J* = 8.0, 2.1, 1.1 Hz, 1H), 7.38 – 7.28 (m, 6H), 6.43 (s, 1H), 4.62 (d, *J* = 5.7 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 166.14, 137.90, 136.23, 134.89, 131.72, 130.05, 128.97, 128.08, 127.89, 127.44, 125.16, 44.38.

N-Benzyl-2-chlorobenzamide 6u[12]

White solid. Mp.91.7-93.3 ℃. (82% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.76 (t, *J* = 1.9 Hz, 1H), 7.65 – 7.62 (m, 1H), 7.45 (ddd, J = 8.0, 2.1, 1.1 Hz, 1H), 7.36 – 7.28 (m, 6H), 6.60 (s, 1H), 4.60 (d, *J* = 5.7 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 166.58, 137.73, 134.99, 131.52, 130.76, 130.37, 130.31, 128.90, 128.01, 127.79, 127.25, 44.34.

N-Benzyl-4-bromobenzamide 6v[10]

White solid. Mp.111.3-113.2 ℃. (87% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.68 – 7.61 (m, 2H), 7.58 – 7.50 (m, 2H), 7.39 – 7.27 (m, 5H), 6.52 (s, 1H), 4.61 (d, *J* = 5.6 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 166.43, 137.94, 133.20, 131.83, 128.85, 128.63, 127.95, 127.75, 126.26, 44.24.

N-Benzyl-4-fluorobenzamide 6w[10]

White solid. Mp.124.1-126.6 ℃. (86% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.82 – 7.75 (m, 2H), 7.38 – 7.26 (m, 5H), 7.12 – 7.05 (m, 2H), 6.47 (s, 1H), 4.61 (d, *J* = 5.6 Hz, 2H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 166.45, 164.85 (d, *J* = 252.0 Hz), 138.11, 130.58 (d, *J* = 3.1 Hz), 129.42 (d, *J* = 9.0 Hz), 128.94, 128.06, 127.83, 115.75 (d, *J* = 22.0 Hz), 44.30.

N-Benzyl-3-methoxybenzamide 6x[13]

White solid. Mp.61.6-62.2 ℃. (89% yield). ^{1}H NMR (400 MHz, CHLOROFORM-D) δ 7.38 (dd, *J* = 2.9, 1.4 Hz, 1H), 7.34 (d, *J* = 4.3 Hz, 4H), 7.32 – 7.26 (m, 3H), 7.02 (ddd, *J* = 7.5, 2.7, 1.7 Hz, 1H), 6.49 (s, 1H), 4.65 – 4.61 (m, 2H), 3.83 (s, 3H). ^{13}C NMR (101 MHz, CHLOROFORM-D) δ 167.35, 159.92, 138.19, 135.91, 129.70, 128.92, 128.04, 127.77, 118.74, 117.93, 112.43, 55.56, 44.26.

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