Oxidative Cleavage of 1,3-Disubstituted Benzo[c]furans with Activated Manganese Dioxide: A Facile Preparation of 1,2-Di(het)aroylbenzenes

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Supporting Information
**General Methods:** All melting points were uncorrected. Solvents were dried by standard procedures. The progression of all the reaction was monitored by TLC using hexanes/ethyl acetate mixture as eluent. Column chromatography was carried out on Silica gel (230-400 mesh, Merck) by using increasing polarity. $^1$H, $^{13}$C and DEPT-135 spectra were recorded in CDCl$_3$ using TMS as an internal standard on a 300 MHz spectrometer at room temperature. Chemical shift values were quoted in parts per million (ppm) and coupling constants ($J$) were quoted in hertz (Hz). Commercially available activated manganese dioxide purchased from Sigma-Aldrich was used in the reaction (CAS number- 1313 13 9). The required benzo[c]furans 1a, 1a, 1b, 1c-k, 1d 3a-d, 1e 5a-b$^2$, 7, 9$^3$, 11a-b$^3$, 13a-b$^2$, 15a-b$^2$, 17, 19$^2$ and 21$^2$, benzo[c]thiophene 1a$^{1c}$ and 1,5 diaryl furans 23a-b$^2$ were prepared using reported procedures.

**General procedure:**

**Oxidative cleavage of benzo[c]furan 1a using MnO$_2$:**

To a stirred solution of benzo[c]furan 1a (0.5 g, 1.77 mmol) in CH$_2$Cl$_2$ (20 mL), MnO$_2$ (0.57 g, 7.09 mmol) was added and stirred at room temperature until the consumption of benzo[c]furan (~4 h). The reaction mixture was then filtered through celite bed and washed with CH$_2$Cl$_2$ (2 x 10 mL). The combined filtrate was concentrated under reduced pressure. Purification of the residue by column chromatography (Silica gel, 5% EA/Hexane) furnished 2a$^2$ as a brown solid (0.48 g, 92%). mp 150-152 °C (Lit.$^1b$ 149-150 °C); $^1$H-NMR (300 MHz, CDCl$_3$): $\delta$ 7.66-7.64 (m, 2H, ArH), 7.58-7.56 (m, 4H, ArH), 7.39-7.38 (m, 2H, ArH), 6.99-6.96 (m, 2H, ArH). $^{13}$C NMR (75 MHz, CDCl$_3$): $\delta$ 188.3, 144.0, 139.4, 135.1, 135.0, 130.6, 129.2, 128.1. Dept 135 (75 MHz, CDCl$_3$): $\delta$ 135.2, 135.0, 130.6, 129.2, 128.1.

**Oxidative cleavage of benzo[c]furan 1a using m-CPBA:$^2$**

To a solution of benzo[c]furan 1a (0.5 g, 1.77 mmol) in CH$_2$Cl$_2$ (15 mL), m-CPBA (0.45 g, 2.60 mmol) was added and the reaction mixture was stirred at room temperature for 5 minutes. It was then poured into saturated sodium bicarbonate solution, extracted with CH$_2$Cl$_2$ (3 x 30 mL). The combined organic extract was washed with water (2 x 30 mL) and dried (Na$_2$SO$_4$). Removal of solvent followed by column chromatographic purification (Silica gel, 5% EA/Hexane) afforded the diketone 2a (0.46 g, 89%).

**Oxidative cleavage of benzo[c]furan 1a using LTA:$^{2,3}$**
To a stirred solution of benzo[c]furan 1a (0.4 g, 1.41 mmol) in dry THF (20 mL), lead tetraacetate (LTA) (0.62 g, 1.41 mmol) was added and then stirred at 50 °C for half an hour. The reaction mixture was then poured into water (200 mL) and extracted with ethyl acetate (2 × 20 mL), washed with brine solution and dried (Na₂SO₄). Removal of solvent in vacuo followed by crystallization from methanol furnished 2a (0.35 g, 83%).

**Attempted oxidative cleavage of benzo[c]thiophene 1a' using MnO₂:**

To a stirred solution of benzo[c]thiophene 1a' (0.25 g, 0.84 mmol) in CH₂Cl₂ (20 mL), MnO₂ (0.29 g, 3.35 mmol) was added and stirred at room temperature. Even after 4 h stirring at rt the benzo[c]thiophene 1a' was not consumed. It was then refluxed for 10 h and the reaction mixture was then filtered through celite bed. Removal of solvent in vacuo didn’t afford the expected diketone 2a, instead starting material 1a' was recovered.

**1,2-Phenylenebis(phenylmethanone) 2b:** Colorless solid; mp 138-139 °C; ¹H-NMR (300 MHz, CDCl₃): δ 7.63 (d, J = 7.2 Hz, 4H, ArH), 7.54 (s, 4H), 7.44 (t, J = 7.2 Hz, 2H, ArH), 7.32-7.27 (m, 4H, ArH). ¹³C-NMR (75 MHz, CDCl₃): δ 196.6, 140.0, 137.2, 133.0, 130.4, 129.8, 129.7, 128.3. Dept-135 (75 MHz, CDCl₃): δ 133.0, 130.4, 129.8, 129.7, 128.3.

**1,2-Phenylenebis(p-tolylmethanone) 2c:** Colorless solid; mp 187-188 °C (Lit. 4 189.7-191.6 °C); ¹H-NMR (300 MHz, CDCl₃): δ 7.62-7.59 (m, 8H, ArH), 7.17 (d, J = 7.5 Hz, 4H, ArH), 2.37 (s, 6H, CH₃). ¹³C-NMR (75 MHz, CDCl₃): δ 196.3, 143.8, 140.2, 134.7, 130.1, 130.0, 129.5, 129.0, 21.7. Dept-135 (75 MHz, CDCl₃): δ 130.2, 130.0, 129.5, 129.0, 21.7.

**1,2-Phenylenebis(naphthalen-1-ylmethanone) 2d:** Colorless solid; mp 128-130 °C; ¹H-NMR (300 MHz, CDCl₃): δ 8.05 (d, J = 8.4 Hz, 2H, ArH), 7.73 (d, J = 8.4 Hz, 2H, ArH) 7.61-7.52 (m, 6H, ArH), 7.40 (d, J = 6.9 Hz, 2H, ArH), 7.29-7.16 (m, 6H, ArH). ¹³C-NMR (75 MHz, CDCl₃): δ 197.9, 141.6, 135.3, 133.7, 133.2, 131.1, 131.0, 130.8, 130.2, 127.9, 127.8, 126.4, 125.5, 123.8. Dept-135 (75 MHz, CDCl₃): δ 133.2, 131.1, 131.0, 130.2, 127.9, 127.8, 126.4, 125.5, 123.8.

**2-Benzoylphenyl)(4-methoxyphenyl)methanone 2e:** Colorless solid; mp 122-124 °C (Lit. 4 118.6-119.1 °C); ¹H-NMR (300 MHz, CDCl₃): δ 7.62-7.58 (m, 5H, ArH), 7.51-7.50 (Broad s, 3H, ArH), 7.41 (t, J = 6.9 Hz, 1H, ArH), 7.30-7.25 (m, 2H, ArH), 6.76 (d, J = 8.1 Hz, 2H, ArH), 3.74 (s, 3H, OCH₃). ¹³C-NMR (75 MHz, CDCl₃): δ 196.7, 195.3, 163.6, 140.4, 139.8, 137.3, 133.0, 132.2, 130.4, 130.2, 130.0, 129.8, 129.6, 129.4, 129.1, 128.3, 113.6, 55.5. Dept-135 (75 MHz, CDCl₃): δ 133.0, 132.20, 130.3, 130.0, 129.8, 129.6, 129.4, 128.3, 113.6, 55.5.
(2-(1-Naphthoyl)phenyl)(p-tolyl)methanone 2f: colorless solid; mp 138-141 °C (Lit.4 139.7-140.4 °C); 1H-NMR (300 MHz, CDCl3): δ 8.34 (d, J = 8.4 Hz, 1H, ArH), 7.99-7.94 (m, 2H, ArH), 7.91-7.86 (m, 9H, ArH), 7.08 (d, J = 7.8 Hz, 2H, ArH), 2.33 (s, 3H, CH3). 13C-NMR (75 MHz, CDCl3): δ 197.5, 196.7, 143.9, 141.2, 140.5, 135.3, 134.9, 133.6, 132.9, 131.5, 130.9, 130.5, 130.1, 129.6, 129.0, 128.1, 127.5, 126.4, 125.8, 125.8, 124.0, 21.6.

(2-Benzoylphenyl)(thiophen-2-yl)methanone 2g: brown solid; mp 135-136 °C (Lit. 4 132.5-133.3 °C); 1H-NMR (300 MHz, CDCl3): δ 7.49 (d, J = 7.5 Hz, 3H, ArH), 7.56-7.53 (m, 4H, ArH), 7.45-7.39 (m, 2H, ArH), 7.31-7.26 (m, 2H, ArH), 6.99-6.96 (m, 1H, ArH). 13C-NMR (75 MHz, CDCl3): δ 196.6, 188.3, 144.1, 139.8, 139.6, 137.2, 135.0, 134.9, 133.1, 130.5, 130.5, 129.8, 129.7, 129.1, 128.3, 128.0. Dept-135 (75 MHz, CDCl3): δ 135.0, 134.9, 133.1, 130.6, 130.5, 129.9, 129.8, 129.1, 128.4, 128.0.

(2-(3,4-Dimethylbenzoyl)phenyl)(4-methoxyphenyl)methanone 2h: colorless solid; mp 132-133 °C; 1H-NMR (300 MHz, CDCl3): δ 7.61 (d, J = 8.4 Hz, 2H, ArH), 7.50 (s, 4H, ArH), 7.41 (s, 1H, ArH), 7.35 (d, J = 7.8 Hz, 1H, ArH), 7.03 (d, J = 7.5 Hz, 1H, ArH), 6.76 (d, J = 8.7 Hz, 2H, ArH), 3.74 (s, 3H, OCH3), 2.19 (s, 3H, CH3), 2.13 (s, 3H, CH3). 13C-NMR (75 MHz, CDCl3): δ 196.6, 195.3, 163.5, 142.6, 140.3, 136.7, 135.1, 132.2, 130.9, 130.3, 130.0, 129.5, 129.3, 127.8, 113.6, 55.5, 20.0, 19.6. Dept-135 (75 MHz, CDCl3): δ 132.2, 130.9, 130.1, 130.0, 129.5, 129.3, 127.8, 113.6, 55.5, 20.1, 19.7.

(2-Benzoylphenyl)(2-methoxynaphthalen-1-yl)methanone 2i: Pale yellow solid; mp 165-166 °C; 1H-NMR (300 MHz, CDCl3): δ 7.87 (d, J = 9 Hz, 1H, ArH), 7.77-7.75 (m, 2H, ArH), 6.4-7.59 (m, 1H, ArH), 7.55-7.52 (m, 2H, ArH), 7.47-7.42 (m, 3H, ArH), 7.37-7.28 (m, 4H, ArH), 7.19 (d, J = 9 Hz, 1H, ArH), 3.74 (s, 3H, OCH3); 13C-NMR (75 MHz, CDCl3): δ 197.3, 195.7, 154.3, 140.7, 137.3, 136.6, 132.1, 131.9, 131.5, 131.2, 128.8, 128.5, 128.0, 127.4, 127.2, 126.9, 123.4, 123.3, 121.0, 112.1, 55.6.

(2-(1-Naphthoyl)phenyl)(2-methoxynaphthalen-1-yl)methanone 2j: Colorless solid; mp 227-228 °C; 1H-NMR (300 MHz, CDCl3): δ 9.06 (d, J = 8.1 Hz, 1H, ArH), 7.90 (d, J = 8.1 Hz, 1H, ArH), 7.81-7.76 (m, 2H, ArH), 7.66-7.65 (m, 3H, ArH), 7.63-7.60 (m, 1H, ArH), 7.53-7.44 (m, 4H, ArH), 7.35-7.32 (m, 2H, ArH), 7.22-7.19 (m, 2H, ArH), 7.17-7.13 (m, 1H, ArH), 3.67 (s, 3H, OCH3); 13C-NMR (75 MHz, CDCl3): δ 199.5, 196.7, 155.1, 142.7, 138.6, 135.1, 133.9, 133.4, 132.3, 131.8, 131.4, 131.2, 130.9, 129.9, 129.1, 128.7, 128.2, 128.0, 127.9, 127.6, 126.9, 126.4,
(2-(1-Naphthoyl)phenyl)(2,4-dimethylphenyl)methanone 2k: Pale yellow solid; mp 89-91 °C; \(^1\)H-NMR (300 MHz, CDCl\(_3\)): \(\delta\) 8.22 (d, \(J = 8.4\) Hz, 1H, ArH), 7.91-7.79 (m, 3H, ArH), 7.13 (d, \(J = 7.8\) Hz, 1H, ArH), 6.89 (d, \(J = 7.5\) Hz, 1H, ArH), 6.70 (s, 1H, ArH), 2.33 (s, 3H, CH\(_3\)), 1.97 (s, 3H, CH\(_3\)); \(^{13}\)C-NMR (75 MHz, CDCl\(_3\)): \(\delta\) 198.0, 197.9, 142.2, 141.6, 141.1, 139.9, 135.4, 133.8, 133.0, 132.5, 131.6, 131.1, 130.9, 130.6, 130.2, 129.7, 128.0, 127.5, 126.5, 125.7, 124.0, 21.3, 20.4; Dept-135(75 MHz, CDCl\(_3\)): \(\delta\) 133.0, 132.5, 131.7, 131.1, 130.0, 129.7, 128.0, 127.5, 126.5, 125.7, 124.0, 21.3, 20.4.

(2-(1-Naphthoyl)phenyl)(3,4-dimethoxyphenyl)methanone 4a: Brown solid; mp 123-125 °C; \(^1\)H-NMR (300 MHz, CDCl\(_3\)): \(\delta\) 8.19 (d, \(J = 8.4\) Hz, 1H, ArH), 7.91 (d, \(J = 8.4\) Hz, 1H, ArH), 7.81-7.73 (m, 2H, ArH), 7.66-7.57 (m, 3H, ArH), 7.48-7.35 (m, 4H, ArH), 7.06-7.03 (m, 1H, ArH), 6.97 (s, 1H, ArH), 6.67 (d, \(J = 8.4\) Hz, 1H, ArH), 3.86 (s, 3H, OCH\(_3\)), 3.65 (s, 3H, OCH\(_3\)); \(^{13}\)C-NMR (75 MHz, CDCl\(_3\)): \(\delta\) 197.6, 195.6, 153.2, 149.0, 141.0, 140.5, 135.3, 133.5, 132.9, 131.5, 131.0, 130.8, 130.4, 130.1, 128.9, 127.9, 127.5, 126.5, 125.8, 125.5, 125.3, 124.0, 110.0, 109.7, 56.0, 55.7.

(2-(3,4-Dimethoxybenzoyl)phenyl(p-tolyl)methanone 4b: Colorless solid; mp 161-163 °C; \(^1\)H-NMR (300 MHz, CDCl\(_3\)): \(\delta\) 7.60-7.55 (m, 6H, ArH), 7.28-7.27 (m, 1H, ArH), 7.22-7.15 (m, 3H, ArH), 6.81 (d, \(J = 8.4\) Hz, 1H, ArH), 3.90 (s, 3H, OCH\(_3\)), 3.83 (s, 3H, OCH\(_3\)), 2.37 (s, 3H, CH\(_3\)); \(^{13}\)C-NMR (75 MHz, CDCl\(_3\)): \(\delta\) 196.3, 195.4, 153.4, 149.0, 140.2, 139.9, 134.8, 130.5, 130.3, 130.1, 129.5, 129.3, 129.0, 125.6, 111.1, 109.7, 56.1, 55.9, 21.7.

(2-Benzoylphenyl)(3,4-bis(hexyloxy)phenyl)methanone 4c: Thick liquid; \(^1\)H-NMR (300 MHz, CDCl\(_3\)): \(\delta\) 7.68 (s, 1H, ArH), 7.66-7.65 (m, 1H, ArH), 7.64-7.61 (m, 4H, ArH), 7.50 (t, \(J = 7.5\) Hz, 1H, ArH), 7.36 (t, \(J = 7.4\) Hz, 2H, ArH), 7.27-7.26 (m, 1H, ArH), 7.20-7.17 (m, 1H, ArH), 6.75 (d, \(J = 8.4\) Hz, 1H, ArH), 4.02 (t, \(J = 6.6\) Hz, 2H, OCH\(_2\)), 3.93 (t, \(J = 6.6\) Hz, 2H, OCH\(_2\)), 1.83-1.78 (m, 4H, CH\(_2\)), 1.46-1.44 (m, 4H, CH\(_2\)), 1.35-1.32 (m, 8H, CH\(_2\)), 0.92-0.88 (m, 6H, CH\(_3\)); \(^{13}\)C-NMR (75 MHz, CDCl\(_3\)): \(\delta\) 196.7, 195.3, 153.6, 148.9, 140.4, 139.8, 137.4, 132.9, 130.3, 130.1, 130.0, 129.8, 129.5, 129.4, 128.3, 125.5, 113.3, 111.3, 69.1, 69.0, 31.5, 29.1, 29.0, 25.7, 25.6, 22.6, 14.0.
(2-(3,4-Bis(hexyloxy)benzoyl)phenyl)(thiophen-2-yl)methanone 4d: Thick liquid; $^1$H-NMR (300 MHz, CDCl$_3$): $\delta$ 7.63-7.62 (m, 1H), 7.54-7.52 (m, 4H), 7.37-7.36 (m, 1H), 7.23 (s, 1H), 7.11 (d, $J$ = 8.4 Hz, 1H), 6.97-6.94 (m, 1H), 6.68-6.65 (m, 1H), 3.95-3.84 (m, 4H), 1.75-1.68 (m, 4H), 1.38-1.36 (m, 4H), 1.27-1.24 (m, 8H), 0.82-0.81 (m, 6H); $^{13}$C-NMR (75 MHz, CDCl$_3$): $\delta$ 194.2, 187.3, 152.7, 147.8, 143.2, 139.0, 138.5, 133.9, 133.6, 129.4, 129.1, 128.5, 128.0, 126.9, 124.5, 112.3, 110.3, 68.1, 68.0, 30.5, 28.0, 27.9, 24.6, 24.5, 21.6, 13.0; Dept-135 (75 MHz, CDCl$_3$): $\delta$ 134.9, 134.7, 130.5, 130.1, 129.5, 129.0, 127.9, 125.5, 113.3, 111.3, 69.1, 69.0, 31.6, 31.5, 29.1, 29.0, 25.7, 25.6, 22.6, 14.0.

Dibenzo[b,d]thiophen-2-yl(2-(thiophene-2-carbonyl)phenyl)methanone 6a: Pale yellow solid; mp 110-112 °C; $^1$H-NMR (300 MHz, CDCl$_3$): $\delta$ 8.43 (s, 1H, ArH), 8.04-8.01 (m, 1H, ArH), 7.79-7.71 (m, 5H, ArH), 7.63-7.58 (m, 2H, ArH), 7.54-7.52 (m, 1H, ArH), 7.47-7.45 (m, 1H, ArH), 7.42-7.37 (m, 2H, ArH), 7.00-6.98 (m, 1H, ArH). $^{13}$C-NMR (75 MHz, CDCl$_3$): $\delta$ 196.2, 188.2, 144.7, 144.0, 139.9, 139.8, 139.6, 135.4, 135.1, 135.0, 134.8, 133.7, 130.6, 130.4, 129.7, 129.2, 128.0, 127.8, 127.7, 127.4, 125.8, 124.8, 122.6, 122.0. DEPT-135 (75 MHz, CDCl$_3$): $\delta$ 135.0, 134.9, 130.6, 130.4, 129.7, 129.2, 128.0, 127.7, 127.4, 124.8, 123.3, 122.8, 122.6, 122.0.

(2-(1-Naphthoyl)phenyl)(dibenzo[b,d]thiophen-2-yl)methanone 6b: Pale yellow solid; mp 87-88 °C; $^1$H-NMR (300 MHz, CDCl$_3$): $\delta$ 8.12 (s, 1H, ArH), 7.99 (d, $J$ = 8.1 Hz, 1H, ArH), 7.91-7.88 (m, 1H, ArH), 7.78 (d, $J$ = 8.1 Hz, 1H, ArH), 7.73-7.68 (m, 2H, ArH), 7.64-7.52 (m, 5H, ArH), 7.48-7.43 (m, 2H, ArH), 7.40-7.31 (m, 2H, ArH), 7.28-7.23 (m, 1H, ArH), 7.16-7.10 (m, 2H, ArH). $^{13}$C-NMR (CDCl$_3$, 75 MHz): $\delta$ 197.3, 196.6, 144.7, 140.9, 140.5, 139.4, 135.4, 135.1, 134.9, 134.1, 133.3, 132.9, 131.6, 130.8, 130.6, 130.4, 129.1, 127.9, 127.3, 127.2, 127.1, 126.2, 125.1, 124.7, 123.9, 122.7, 122.5, 122.4, 121.8. DEPT-135 (75 MHz, CDCl$_3$): $\delta$ 133.0, 131.7, 130.9, 130.7, 130.5, 129.2, 128.0, 127.4, 127.3, 127.2, 126.3, 125.2, 124.8, 123.9, 122.8, 122.6, 122.5, 121.9.

2,2'-Bithiophen-5-yl(2-(4-methylbenzoyl)phenyl)methanone 8: Brown solid; mp 141-143 °C; $^1$H-NMR (300 MHz, CDCl$_3$): $\delta$ 7.67-7.64 (m, 1H, ArH), 7.56-7.50 (m, 5H, ArH), 7.30-7.18 (m, 3H, ArH), 7.1 (d, $J$ = 8.1 Hz, 2H, ArH), 7.03 (d, $J$ = 3.9 Hz, 1H, ArH), 6.98-6.94 (m, 1H, ArH), 2.31 (s, 3H, CH$_3$). $^{13}$C-NMR (75 MHz, CDCl$_3$): $\delta$ 196.2, 187.9, 146.7, 144.0, 142.1, 139.8, 139.4, 136.2, 135.9, 134.7, 130.4, 130.3, 130.0, 129.6, 129.0, 128.9, 128.2, 126.6, 125.8, 124.1,
21.7. Dept-135 (75 MHz, CDCl$_3$): $\delta$ 135.9, 130.4, 130.3, 130.0, 129.6, 129.0, 128.9, 128.2, 126.6, 125.8, 124.1, 21.7.

**2-Benzoylephenyl(biphenyl-4-yl) methanone 10a**:
Pale yellow solid; mp 152-155 °C; $^1$H-NMR (300 MHz, CDCl$_3$): $\delta$ 7.70 (d, $J = 8.1$ Hz, 2H, ArH), 7.64 (d, $J = 7.2$ Hz, 2H, ArH), 7.56-7.55 (m, 3H, ArH), 7.53 (broad s, 2H, ArH), 7.50 (broad s, 2H, ArH), 7.44-7.39 (m, 2H, ArH), 7.36-7.27 (m, 5H, ArH); $^{13}$C-NMR (75 MHz, CDCl$_3$): $\delta$ 196.6, 196.2, 145.7, 140.2, 139.9, 139.0, 137.2, 135.9, 133.0, 130.4, 130.3, 130.0, 129.8, 129.6, 128.9, 128.8, 128.4, 128.2, 127.3, 127.2, 127.0; Dept-135(75 MHz, CDCl$_3$): $\delta$ 130.4, 130.3, 130.1, 129.7, 129.5, 129.1, 128.9, 128.2, 127.3, 127.0.

**Biphenyl-4-yl(2-(3-hexylthiophene-2-carbonyl)phenyl)methanone 10b**:
Thick liquid; $^1$H-NMR (300 MHz, CDCl$_3$): $\delta$ 7.82-7.78 (m, 2H, ArH), 7.71-7.68 (m, 1H, ArH), 7.64-7.58 (m, 7H, ArH), 7.47-7.38 (m, 4H, ArH), 6.96-6.94 (m, 1H, ArH), 2.78-2.73 (m, 2H, ArH), 1.50-1.42 (m, 2H, CH$_2$), 1.26-1.21 (m, 6H, CH$_2$), 0.88-0.86 (m, 3H, CH$_3$); $^{13}$C-NMR (75 MHz, CDCl$_3$): $\delta$ 195.9, 189.2, 151.9, 145.6, 142.1, 139.9, 139.1, 136.0, 135.5, 131.8, 131.1, 130.5, 130.2, 129.8, 129.0, 128.9, 128.2, 127.3, 127.0, 31.6, 30.2, 30.1, 29.3, 22.6, 14.1.

**Benzo[b]thiophen-3-yl(2-(4-methylbenzoyl)phenyl)methanone 12a**:
Colorless solid; mp 103-104 °C; $^1$H-NMR (300 MHz, CDCl$_3$): $\delta$ 8.25-8.22 (m, 1H, ArH), 7.74 (s, 1H, ArH), 7.70-7.60 (m, 2H, ArH), 7.53 -7.41 (m, 4H, ArH), 7.40 (d, $J = 8.1$ Hz, 2H, ArH), 7.32-7.30 (m, 1H, ArH), 7.07-7.05 (m, 1H, ArH), 6.95-6.93 (m, 1H, ArH), 2.18 (s, 3H, CH$_3$); $^{13}$C-NMR (75 MHz, CDCl$_3$): $\delta$ 196.4, 190.7, 144.0, 140.9, 140.1, 139.8, 139.4, 136.6, 134.9, 130.7, 130.5, 130.1, 129.6, 129.4, 129.1, 129.0, 125.5, 125.4, 125.2, 122.0, 21.6.

**2-Methylbenzo[b]thiophen-3-yl(2-(thiophen-2-carbonyl)phenyl)methanone 12b**:
Thick liquid; $^1$H-NMR (300 MHz, CDCl$_3$): $\delta$ 7.70-7.60 (m, 5H, ArH), 7.54-7.48 (m, 2H, ArH), 7.34-7.33 (m, 1H, ArH), 7.26-7.15 (m, 2H, ArH), 7.01-6.98 (m, 1H, ArH), 2.34 (s, 3H, CH$_3$); $^{13}$C-NMR (75 MHz, CDCl$_3$): $\delta$ 192.3, 188.1, 150.6, 144.2, 141.2, 139.8, 138.7, 137.4, 134.9, 134.7, 132.3, 131.3, 130.8, 129.2, 128.9, 128.0, 124.8, 124.3, 123.4, 121.3, 15.9.

**2-(4-(Diphenylamino)benzoyl)phenyl(thiophen-2-yl)methanone 14a**:
Pale yellow solid; mp 140-141 °C; $^1$H-NMR (300 MHz, CDCl$_3$): $\delta$ 7.65-7.40 (m, 8H, ArH), 7.26-7.19 (m, 5H, ArH), 7.07-7.00 (m, 6H, ArH), 6.82 (d, $J = 8.7$ Hz, 2H, ArH). $^{13}$C-NMR (75 MHz, CDCl$_3$): $\delta$ 194.9, 188.5, 152.2, 146.4, 144.3, 140.3, 139.6, 135.1, 134.7, 131.6, 130.4, 130.0, 129.65, 129.6, 129.4,
(2-(4-(Diphenylamino)benzoyl)phenyl)(4-methoxyphenyl)methanone 14b: Pale yellow solid; mp 143-145 °C; ¹H-NMR (300 MHz, CDCl₃): δ 7.64 (d, J = 8.7 Hz, 2H, ArH), 7.52-7.44 (m, 6H, ArH), 7.24-7.19 (m, 4H, ArH), 7.05-7.02 (m, 6H, ArH), 6.82-6.77 (m, 4H, ArH), 3.76 (s, 3H, OCH₃). ¹³C-NMR (75 MHz, CDCl₃): δ 195.5, 195.0, 163.5, 152.1, 146.4, 140.4, 140.2, 132.3, 131.6, 130.3, 129.9, 129.8, 129.7, 129.6, 129.3, 129.2, 129.0, 124.7, 119.4, 113.6, 55.5. DEPT-135 (75 MHz, CDCl₃): δ 132.3, 131.6, 129.9, 129.8, 129.6, 129.3, 129.2, 126.0, 124.7, 119.4, 113.6, 55.5.

(9-Hexyl-9H-carbazol-3-yl)(2-(4-methylbenzoyl)phenyl)methanone 16a: Thick yellow liquid; ¹H-NMR (300 MHz, CDCl₃): δ 8.38 (s, 1H, ArH), 7.94 (d, J = 7.8 Hz, 1H, ArH), 7.79 (d, J = 8.7 Hz, 1H, ArH), 7.63-7.52 (m, 6H, ArH), 7.37 (d, J = 7.5 Hz, 1H, ArH), 7.31 (d, J = 8.1 Hz, 1H, ArH), 7.23 (d, J = 8.7 Hz, 1H, ArH), 7.15 (t, J = 7.4 Hz, 1H, ArH), 7.03 (d, J = 8.1 Hz, 2H, ArH), 4.18 (t, J = 7.2 Hz, 2H, NCH₂), 2.24 (s, 3H, ArCH₃), 1.78-1.71 (m, 2H, CH₂), 1.22-1.20 (m, 6H, CH₂), 0.77 (t, J = 6.8 Hz, 3H, CH₃). ¹³C-NMR (75 MHz, CDCl₃): δ 196.5, 196.2, 143.7, 143.2, 141.0, 140.9, 140.2, 134.8, 130.0, 129.9, 129.8, 129.5, 129.4, 128.9, 128.5, 128.0, 126.3, 123.7, 123.1, 122.4, 120.7, 119.8, 109.1, 108.2, 43.2, 31.46, 28.8, 26.8, 22.4, 21.6, 13.9. DEPT-135 (75 MHz, CDCl₃): δ 130.0, 129.9, 129.8, 129.5, 129.4, 128.9, 128.0, 126.3, 123.7, 120.6, 119.8, 109.1, 108.2, 43.2, 31.4, 28.8, 26.8, 22.4, 21.6, 13.9.

(9-Hexyl-9H-carbazol-3-yl)(2-(4-methoxybenzoyl)phenyl)methanone 16b: Pale yellow solid; mp 172-173 °C; ¹H-NMR (300 MHz, CDCl₃): δ 8.37 (s, 1H, ArH), 7.92 (d, J = 7.8 Hz, 1H, ArH), 7.78 (d, J = 8.4 Hz, 1H, ArH), 7.60-7.58 (m, 3H, ArH), 7.51-7.49 (m, 3H, ArH), 7.36-7.27 (m, 2H, ArH), 7.21 (d, J = 8.7 Hz, 1H, ArH), 7.15-7.13 (m, 1H, ArH), 6.69 (d, J = 8.7 Hz, 2H, ArH), 4.15 (t, J = 7.2 Hz, 2H, NCH₂), 3.66 (s, 3H, OCH₃), 1.75-1.71 (m, 2H, CH₂), 1.26-1.17 (m, 6H, CH₂), 0.75 (t, J = 6.6 Hz, 3H, CH₃). ¹³C-NMR (75 MHz, CDCl₃): δ 196.3, 195.5, 163.5, 143.3, 141.1, 140.9, 140.5, 132.2, 130.4, 129.9, 129.8, 129.6, 129.3, 128.6, 128.1, 126.4, 123.8, 123.2, 122.5, 120.7, 119.9, 113.5, 109.2, 108.3, 55.4, 43.3, 31.5, 28.9, 26.9, 22.5, 14.0. DEPT-135 (75 MHz, CDCl₃): δ 132.2, 129.9, 129.8, 129.6, 129.3, 128.1, 126.4, 123.8, 120.9, 119.9, 113.5, 109.2, 108.3, 55.4, 43.3, 31.5, 28.8, 26.9, 22.5, 14.0.

(9,9-Dihexyl-9H-fluoren-2-yl)(2-(4-methylbenzoyl)phenyl)methanone 18: Pale yellow solid; mp 90-91 °C (uncorrected); ¹H-NMR (300 MHz, CDCl₃): δ 7.64-7.53 (m, 10H, ArH), 7.6
(Broad s, 3H, ArH), 7.06 (d, J = 7.5 Hz, 2H, ArH), 2.27 (s, 3H, CH3), 1.87-1.82 (m, 4H, CH2), 1.04-0.95 (m, 12H, CH2), 0.70-0.44 (m, 10H, CH2CH3). 13C-NMR (75 MHz, CDCl3): δ 196.5, 196.3, 152.1, 150.8, 146.0, 143.8, 140.4, 140.2, 139.8, 135.8, 134.8, 130.3, 130.1, 129.7, 129.4, 129.0, 128.4, 127.0, 124.0, 123.1, 120.7, 119.2, 55.2, 40.1, 31.5, 29.6, 23.7, 22.6, 21.6, 14.0. Dept-135 (75 MHz, CDCl3): δ 130.3, 130.1, 130.0, 129.7, 129.4, 129.0, 128.4, 127.0, 124.0, 123.1, 120.7, 119.2, 40.1, 31.5, 29.6, 23.7, 22.6, 21.6, 14.0.

(2-(4-Methylbenzoyl)phenyl)(pyren-1-yl)methanone 20: Pale yellow solid; mp 64-65 °C; 1H-NMR (300 MHz, CDCl3): δ 8.43 (d, J = 9.3 Hz, 1H, ArH), 8.02-7.79 (m, 8H, ArH), 7.56-7.37 (m, 6H, ArH), 6.86 (d, J = 8.1 Hz, 2H, ArH), 2.10 (s, 3H, CH3). 13C-NMR (75 MHz, CDCl3): δ 197.9, 196.7, 143.8, 141.2, 140.8, 134.7, 133.7, 131.6, 131.2, 130.8, 130.34, 130.29, 129.8, 129.5, 129.0, 128.9, 128.5, 126.9, 126.2, 126.1, 126.0, 124.6, 124.4, 123.9, 123.4, 21.4. DEPT-135 (75 MHz, CDCl3): δ 130.2, 129.8, 128.9, 128.5, 128.0, 127.0, 127.0, 125.9, 125.2, 125.1, 125.0, 123.7, 122.4, 20.5.

(2-(Dibenzo[b,d]furan-2-carbonyl)phenyl)(5-hexylthiophen-2-yl)methanone 22: Thick red liquid; 1H-NMR (300 MHz, CDCl3): δ 8.35 (s, 1H, ArH) 7.92-7.86 (m, 2H, ArH), 7.80-7.77 (m, 1H, ArH), 7.68-7.64 (m, 3H, ArH), 7.60-7.46 (m, 3H, ArH), 7.38-7.33 (m, 2H, ArH), 6.77-6.76 (m, 1H, ArH), 2.77 (t, J = 7.5, 2H, CH2), 1.68-1.60 (m, 2H, CH2), 1.27-1.24 (m, 6H, CH2), 0.82 (t, J = 6.4 Hz, 3H, CH3); 13C-NMR (75 MHz, CDCl3): δ 196.1, 187.9, 158.9, 157.5, 156.8, 141.5, 140.0, 139.8, 135.7, 132.6, 130.5, 130.3, 129.5, 129.1, 127.9, 125.6, 124.4, 123.7, 123.3, 123.2, 121.1, 111.9, 111.5, 31.4, 31.2, 30.7, 28.7, 22.5, 14.1.

Attempted oxidative cleavage of furan 23a using MnO2:

To a stirred solution of furan 23a (0.2 g, 0.90 mmol) in CH2Cl2 (20 mL), MnO2 (0.31 g, 3.63 mmol) was added and stirred at room temperature for 4 h. The furan was not consumed in the reaction and it was then refluxed for 10 h. The reaction mixture was filtered through celite bed and washed with CH2Cl2 (2 x 10 mL). Removal of solvent in vacuo didn’t afford the expected diketone 24a, instead, starting material 23a was recovered.

Attempted oxidative cleavage of furan 23b using MnO2:

To a stirred solution of furan 23b (0.2 g, 0.86 mmol) in CH2Cl2 (20 mL), MnO2 (0.29 g, 3.44 mmol) was added and stirred at room temperature for 4 h. The furan was not consumed in the reaction and it was then refluxed for 10 h. The reaction mixture was filtered through celite bed
and washed with CH$_2$Cl$_2$ (2 x 10 mL). Removal of solvent in vacuo didn’t afford the expected diketone 24b, instead, starting material 23b was recovered.
References


