Electronic Supplementary Information

Naphtho[2,3-b]furan-4,9-diones synthesis via palladium-catalyzed reverse hydrogenolysis

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General information:

All reagents were obtained from commercial suppliers unless otherwise stated. DMA were distilled from magnesium sulfate under vacuum. The Pd/C was first washed with acetone and then was dried under reduced pressure at 80 °C before used. All corresponding glassware was oven dried (120 °C) and cooled under a stream of Argon gas. Flash chromatography was performed using silica gel (300-400 mesh) with solvents distilled prior to use. Visualization was achieved under a UV lamp (254 nm and 365nm).\textsuperscript{1}H-NMR (400MHz) and \textsuperscript{13}C-NMR (100 MHz) spectra were obtained on a Bruker DRX-400 NMR as solutions indicated. Chemical shifts are reported in parts per million and coupling constants are in hertz. The chemical structures of products were confirmed by GC-MS (Agilent Technologies, GC7683B, MS5973) and \textsuperscript{1}H-NMR (400 MHz) and \textsuperscript{13}C-NMR (100 MHz).
General procedure for synthesis of substrates:

General Procedure A

Fig S1. General Procedure A

The reaction flask was first degassed and then sealed with an O₂ balloon. All the reactants and solvent was added under a O₂ atmosphere. Add a solution of potassium t-butoxide in t-butanol (1 M, 40 ml) to a solution of a-tetralone (185 mCi, 5 mmol) t-butanol (10ml). The mixture was stirred under an oxygen atmosphere. After 2 h TLC of an aliquot quenched with 2 N HCl showed complete absence of a-tetralone. The reaction mixture was acidified with 2 N HCl (10 ml) and extracted with CHCl₃(20 ml). The combined organic solution was extracted with a saturated solution of NaHCO₃(10 ml). Acidification of the NaHCO₃ extract with 6N HCl yielded a yellow solid, which was filtered and dried. Recrystallization from ethyl acetate–petroleum ether (19:1) gave 0.4 g (46%) of bright yellow solid of 1 with a purity of 99%.

1a 2-hydroxy-1,4-naphthoquinone
Yellow solid, yield: 70%. ¹H-NMR (400 MHz, Chloroform-d) δ 8.12 (d, J = 7.6 Hz, 2H), 7.80 (t, J = 7.5 Hz, 1H), 7.72 (t, J = 7.5 Hz, 1H), 7.37 (s, 1H), 6.37 (s, 1H). HR-MS: m/z calcd for C₁₀H₆O₃: 174.0317; found: 174.0318.

1b 6-methoxy-2-hydroxy-1,4-naphthoquinone
Yellow solid, yield: 72%. ¹H-NMR (400 MHz, CDCl₃) δ 8.06 (d, J = 8.6 Hz, 1H), 7.57 (d, J = 2.4 Hz, 1H), 7.46 (s, 1H), 7.16 (dd, J = 8.6, 2.4 Hz, 1H), 6.31 (s, 1H), 3.97 (s, 3H). HR-MS: m/z calcd for C₁₁H₈O₄: 204.0423; found: 204.0424.
General Procedure B

(1) To a solution of benzaldehyde (15 mmol, 1.59 g) in 10 ml ethyl alcohol, added acetophenone (10 mmol, 1.2 g) in 5 ml H2O. Stirred for 10 min, then dropwise added NaOH (30 mmol, 1.2 g) in 5 ml H2O. Stirred for another 2 h at room temperature after TLC showed complete absence of acetophenone. A yellow solid was separated out. Filtrated to get raw product. Recrystallization from ethyl acetate–petroleum ether (30:1) gave 1.64 g (79%) of bright yellow needles of 2a-2r and 2t-2w with a radiochemical purity of 99%.

(2) A solution of aldehyde (33 mmol) in acetone (10 mL) and water (1 mL) was placed in a water bath. The reaction mixture was stirred and 10% solution of NaOH (1 mL) was added slowly. The reaction mixture was then stirred for 6 h at room temperature and acidied with 1 M HCl to pH=2. The product was extracted with ethyl acetate (3×40 mL). The organic layer was washed with brine, dried over anhydrous MgSO4. After evaporation of solvent in vacuo pure ketone 2s was obtained.

2a 1,3-Diphenyl-propenone
Light yellow solid, yield: 79%. 1H-NMR (400 MHz, Chloroform-d) δ 8.03 (d, J = 7.3 Hz, 2H), 7.82 (d, J = 15.7 Hz, 1H), 7.65 (dd, J = 6.5, 2.8 Hz, 2H), 7.62 – 7.53 (m, 2H), 7.51 (t, J = 5.5 Hz, 2H), 7.46 – 7.38 (m, 3H). HR-MS: m/z calcd for C15H12O: 208.0888; found: 208.0888. These characterization data are matched with those previously reported 2.

2b 3-(4-Methoxy-phenyl)-1-phenyl-propenone
Yellow solid, yield: 76%. 1H-NMR (400 MHz, Chloroform-d) δ 8.02 (d, J = 7.7 Hz, 2H), 7.78 (d, J = 15.7 Hz, 1H), 7.57 – 7.47 (m, 4H), 7.43 (d, J = 5.1 Hz, 2H), 7.29 (t, J = 7.8 Hz, 1H), 7.20 (d, J = 7.4 Hz, 1H), 2.37 (s, 3H). HR-MS: m/z calcd for C16H14O2: 238.0994; found: 238.0996. These characterization data are matched with those previously reported 2.

2c 1-phenyl-3-p-tolyl-propenone
Yellow solid, yield: 71%. 1H-NMR (400 MHz, Chloroform-d) δ 8.01 (d, J = 7.4 Hz, 2H), 7.79 (d, J = 15.7 Hz, 1H), 7.51 (dq, J = 15.5, 8.0, 6.9 Hz, 6H), 7.20 (d, J = 7.9 Hz, 2H), 2.37 (s, 3H). HR-
MS: m/z calcd for C_{16}H_{14}O: 222.1045; found: 222.1044. These characterization data are matched with those previously reported.

2d 1-phenyl-3-m-tolyl-propenone
Yellow solid, yield: 69%. ¹H-NMR (400 MHz, Chloroform-d) δ 8.02 (d, J = 7.3 Hz, 2H), 7.79 (d, J = 15.7 Hz, 1H), 7.58 (t, J = 7.3 Hz, 1H), 7.54 – 7.47 (m, 3H), 7.44 (d, J = 6.4 Hz, 2H), 7.30 (t, J = 7.9 Hz, 1H), 7.23 (t, J = 7.2 Hz, 1H), 2.39 (s, 3H). HR-MS: m/z calcd for C_{16}H_{14}O: 222.1045; found: 222.1045.

2e 3- (4-Chlorophenyl)-1-phenyl-propenone
Yellow solid, yield: 57%. ¹H-NMR (400 MHz, Chloroform-d) δ 7.99 (d, J = 7.6 Hz, 2H), 7.71 (d, J = 15.7 Hz, 1H), 7.58 – 7.43 (m, 6H), 7.33 (d, J = 8.3 Hz, 2H). HR-MS: m/z calcd for C_{16}H_{11}ClO: 242.0498; found: 242.0497. These characterization data are matched with those previously reported.

2f 3- (4-Fluorophenyl)-1-phenyl-propenone
Yellow solid, yield: 50%. ¹H-NMR (400 MHz, Chloroform-d) δ 8.02 (d, J = 7.5 Hz, 2H), 7.76 (d, J = 15.7 Hz, 1H), 7.58 (dq, J = 14.2, 7.3, 6.5 Hz, 3H), 7.51 – 7.42 (m, 3H), 7.07 (t, J = 8.5 Hz, 2H). HR-MS: m/z calcd for C_{16}H_{11}ClO: 226.0794; found: 226.0794. These characterization data are matched with those previously reported.

2g 3-phenyl-1-o-tolyl-propenone
Yellow solid, yield: 71%. ¹H-NMR (400 MHz, Chloroform-d) δ 7.54 – 7.45 (m, 3H), 7.45 (d, J = 12.4 Hz, 1H), 7.34 (t, J = 4.5 Hz, 4H), 7.27 – 7.20 (m, 2H), 7.12 (d, J = 16.1 Hz, 1H), 2.43 (s, 3H). HR-MS: m/z calcd for C_{16}H_{14}O: 222.1045; found: 222.1044. These characterization data are matched with those previously reported.

2h 3-phenyl-1-p-tolyl-propenone
Yellow solid, yield: 79%. ¹H-NMR (400 MHz, Chloroform-d) δ 7.95 (d, J = 8.0 Hz, 2H), 7.81 (d, J = 15.7 Hz, 1H), 7.68 – 7.62 (m, 2H), 7.55 (d, J = 15.7 Hz, 1H), 7.45 – 7.39 (m, 3H), 7.31 (d, J = 7.9 Hz, 2H), 2.44 (s, 3H). HR-MS: m/z calcd for C_{16}H_{14}O: 222.1045; found: 222.1045. These characterization data are matched with those previously reported.
2i 1-(4-isobutyl-phenyl)-3 phenyl –propenone
Yellow solid, yield: 77%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 7.96 (d, J = 8.0 Hz, 2H), 7.81 (d, J = 15.7 Hz, 1H), 7.67 – 7.61 (m, 2H), 7.55 (d, J = 15.7 Hz, 1H), 7.40 (d, J = 4.5 Hz, 4H), 7.27 (d, J = 8.0 Hz, 2H), 2.55 (d, J = 7.2 Hz, 2H), 1.91 (m, J = 13.5, 6.7 Hz, 1H), 0.92 (d, J = 6.6 Hz, 6H). HR-MS: m/z calcd for C$_{19}$H$_{20}$O: 264.1514; found: 264.1513.

2j 1-(4-Methoxy-phenyl)-3-phenyl-propenone
Yellow solid, yield: 77%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.05 (d, J = 8.9 Hz, 2H), 7.81 (d, J = 15.7 Hz, 1H), 7.64 (dd, J = 6.5, 2.8 Hz, 2H), 7.55 (d, J = 15.7 Hz, 1H), 7.41 (dd, J = 5.1, 1.8 Hz, 3H), 6.98 (d, J = 8.9 Hz, 2H), 3.87 (s, 3H). HR-MS: m/z calcd for C$_{16}$H$_{14}$O$_2$: 238.0994; found: 238.0992

These characterization data are matched with those previously reported $^2$.

2k 1- (4-Chlorophenyl)-3-phenyl-propenone
Yellow solid, yield: 57%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 7.98 – 7.93 (d, 2H), 7.81 (d, J = 15.7 Hz, 1H), 7.65 – 7.60 (m, 2H), 7.52 – 7.43 (m, 3H), 7.42 (q, J = 3.4 Hz, 3H). HR-MS: m/z calcd for C$_{16}$H$_{11}$ClO: 242.0498; found: 242.0497. These characterization data are matched with those previously reported $^2$.

2l 1,3-Di-p-tolyl-propenone
Yellow solid, yield: 67%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 7.95 (d, J = 8.2 Hz, 2H), 7.80 (d, J = 15.7 Hz, 1H), 7.56 – 7.47 (m, 3H), 7.29 (d, J = 8.0 Hz, 2H), 7.21 (d, J = 7.9 Hz, 2H), 2.42 (s, 3H), 2.38 (s, 3H). HR-MS: m/z calcd for C$_{17}$H$_{16}$O: 236.1201; found: 236.1201. These characterization data are matched with those previously reported $^5$.

2m 3-(4-Ethyl-phenyl)-1-(4-methoxy-phenyl)- propenone
Yellow solid, yield: 79%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.04 (d, J = 8.8 Hz, 2H), 7.80 (d, J = 15.6 Hz, 1H), 7.57 (d, J = 8.0 Hz, 2H), 7.51 (d, J = 15.6 Hz, 1H), 7.25 (d, J = 7.9 Hz, 2H), 6.98 (d, J = 8.8 Hz, 2H), 3.89 (s, 3H), 2.69 (q, J = 7.6 Hz, 2H), 1.26 (t, J = 7.6 Hz, 3H). HR-MS: m/z calcd for C$_{18}$H$_{18}$O$_2$: 266.1307; found: 266.1309.
2n 3-m-Tolyl-1-p-tolyl-propenone
Yellow solid, yield: 78%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 7.96 (d, J = 8.1 Hz, 2H), 7.79 (d, J = 15.7 Hz, 1H), 7.53 (d, J = 15.7 Hz, 1H), 7.45 (d, J = 5.6 Hz, 2H), 7.30 (d, J = 7.5 Hz, 3H), 7.22 (d, J = 7.5 Hz, 1H), 2.43 (s, 3H), 2.39 (s, 3H). HR-MS: m/z calcd for C$_{17}$H$_{16}$O: 236.1201; found: 236.1201. These characterization data are matched with those previously reported 4.

F
Cl

2o 3-(4-Fluoro-phenyl)-1-p-tolyl-propenone
Yellow solid, yield: 66%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 7.93 (d, J = 8.1 Hz, 2H), 7.75 (d, J = 15.7 Hz, 1H), 7.61 (dd, J = 8.5, 5.5 Hz, 2H), 7.45 (d, J = 15.7 Hz, 1H), 7.28 (d, J = 8.0 Hz, 2H), 7.08 (t, J = 8.6 Hz, 2H), 2.41 (s, 3H). HR-MS: m/z calcd for C$_{16}$H$_{13}$FO: 240.0950; found: 240.0948. These characterization data are matched with those previously reported 4.

Cl
Cl

2p 1,3-Bis-(4-chloro-phenyl)-propenone
Yellow solid, yield: 50%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 7.95 (d, J = 8.5 Hz, 2H), 7.75 (d, J = 15.7 Hz, 1H), 7.56 (d, J = 8.4 Hz, 2H), 7.49 – 7.41 (m, 3H), 7.38 (d, J = 8.4 Hz, 2H). HR-MS: m/z calcd for C$_{15}$H$_{10}$Cl$_2$O: 276.0109; found: 276.0111. These characterization data are matched with those previously reported 6.

Cl

2q 1-(4-Chloro-phenyl)-3-(4-fluoro-phenyl)-propenone
Yellow solid, yield: 59%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 7.94 (d, J = 8.2 Hz, 2H), 7.76 (d, J = 15.6 Hz, 1H), 7.66 – 7.56 (m, 2H), 7.45 (d, J = 8.2 Hz, 2H), 7.40 (d, J = 15.8 Hz, 1H), 7.09 (t, J = 8.2 Hz, 2H). HR-MS: m/z calcd for C$_{15}$H$_{10}$ClFO: 260.0404; found: 260.0402.

2r 3-Naphthalen-2- phenyl-propenone
Yellow solid, yield: 77%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.64 (d, J = 15.4 Hz, 1H), 8.20 (d, J = 8.2 Hz, 1H), 8.05 (d, J = 7.4 Hz, 2H), 7.84 (q, J = 7.0, 6.4 Hz, 3H), 7.62 – 7.50 (m, 3H), 7.50 – 7.40 (m, 4H). HR-MS: m/z calcd for C$_{19}$H$_{14}$O: 258.1045; found: 258.1045. These characterization data are matched with those previously reported 3.
2s 4-phenyl-but-3-en-2-one
White solid, yield: 49%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 7.55 – 7.51 (m, 2H), 7.48 (s, 1H), 7.40 – 7.35 (m, 3H), 6.70 (d, J = 16.3 Hz, 1H), 2.36 (s, 3H). HR-MS: m/z calcd for $\text{C}_{10}\text{H}_{10}\text{O}$: 146.0732; found: 146.0732.

2t 1,5-Diphenyl-penta-1,4-dien-3-one
Yellow solid, yield: 77%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 7.74 (d, J = 16.0 Hz, 2H), 7.59 (dd, J = 6.2, 2.5 Hz, 4H), 7.43 – 7.35 (m, 6H), 7.08 (d, J = 16.0 Hz, 2H). HR-MS: m/z calcd for $\text{C}_{17}\text{H}_{14}\text{O}$: 234.1045; found: 234.1045.

2u 1-phenyl-5-p-tolyl-penta-1,4-dien-3-one
Yellow solid, yield: 67%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 7.75 (d, J = 3.2 Hz, 1H), 7.71 (d, J = 3.1 Hz, 1H), 7.65 – 7.60 (m, 2H), 7.52 (d, J = 7.9 Hz, 2H), 7.41 (d, J = 3.8 Hz, 3H), 7.22 (d, J = 7.8 Hz, 2H), 7.07 (t, J = 16.1 Hz, 2H), 2.39 (s, 3H). HR-MS: m/z calcd for $\text{C}_{18}\text{H}_{16}\text{O}$: 248.1201; found: 248.1199.

2v 1-(4-Chloro-phenyl)-5-phenyl-penta-1,4-dien-3-one
Yellow solid, yield: 50%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 7.74 (d, J = 16.0 Hz, 1H), 7.68 (d, J = 15.9 Hz, 1H), 7.61 (dd, J = 6.5, 2.9 Hz, 2H), 7.54 (d, J = 8.5 Hz, 2H), 7.44 – 7.40 (m, 3H), 7.38 (d, J = 8.5 Hz, 2H), 7.08 (d, J = 2.9 Hz, 1H), 7.04 (d, J = 2.9 Hz, 1H). HR-MS: m/z calcd for $\text{C}_{17}\text{H}_{13}\text{ClO}$: 268.0655; found: 268.0657.

2w 1,5-Di-p-tolyl-penta-1,4-dien-3-one
Yellow solid, yield: 71%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 7.72 (d, J = 15.9 Hz, 2H), 7.52 (d, J = 8.0 Hz, 4H), 7.22 (d, J = 7.8 Hz, 4H), 7.04 (d, J = 15.9 Hz, 2H), 2.39 (s, 6H). HR-MS: m/z calcd for $\text{C}_{19}\text{H}_{18}\text{O}$: 262.1358; found: 262.1356.
Reaction optimization for the synthesis of naphtho[2,3-b]furan-4,9-diones.\textsuperscript{a}

![Diagram of chemical reaction]

<table>
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<th>Yield,% \textsuperscript{b}</th>
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\textsuperscript{a} Reaction conditions: 0.2mmol substrates. \textsuperscript{b} Isolated yields

S9
General procedure for synthesis of naphtho[2,3-b]furan-4,9-diones compounds

2-hydroxide-1,4-naphthoquinone (0.2 mmol), 1,3-Diphenyl- propenone (0.4 mmol), Pd/C (21.2 mg, 0.02 mmol Pd), Cs$_2$CO$_3$ (13.03 mg, 0.04 mmol), and DMA (1 ml) were added to a two-necks reaction flask loaded with a stir bar. The reaction flask was first degassed under the oil pump, and then sealed with a N$_2$ balloon. The reaction was heated in an oil bath to 130$^\circ$C with vigorous stirring for an appropriate time, detected by GC and TLC. After the 2-hydroxide-1,4-naphthoquinone was completely disappeared, the solvent was evaporated under reduced pressure. The residue was purified by a silica gel column chromatography (ethylacetate/ petroleum ether=1:100) given a pure product of light yellow solid.

3a 2-Benzoyl-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-dione
Yellow solid, yield: 83%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.23 (d, J = 7.5 Hz, 1H), 8.01 (dd, J = 14.3, 7.6 Hz, 3H), 7.75 (dd, J = 6.6, 3.9 Hz, 3H), 7.69 (t, J = 7.3 Hz, 1H), 7.61 (t, J = 7.4 Hz, 1H), 7.47 (t, J = 7.7 Hz, 2H), 7.37 (q, J = 5.4 Hz, 3H). $^{13}$C-NMR (101 MHz, Chloroform-d) $\delta$ 190.71, 179.63, 173.15, 156.76, 150.56, 136.61, 134.37, 134.14, 133.97, 132.81, 132.46, 130.80 (d, J = 4.4 Hz), 129.53, 129.07, 128.97, 127.47, 127.09, 126.95, 118.81. HR-MS: m/z calcd for C$_{25}$H$_{14}$O$_4$ :378.0892; found:378.0892.

3b 2-Benzoyl-3-(4-methoxylphenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione
Yellow solid, yield: 80%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.27 – 8.21 (m, 1H), 8.05 – 7.99 (m, 1H), 7.99 – 7.94 (m, 2H), 7.79 – 7.66 (m, 4H), 7.61 (t, J = 7.4 Hz, 1H), 7.46 (t, J = 7.7 Hz, 2H), 6.88 (d, J = 8.9 Hz, 2H), 3.81 (s, 3H). $^{13}$C-NMR (101 MHz, Chloroform-d) $\delta$ 191.33, 180.12, 173.35, 161.95, 157.58, 150.41, 137.08, 134.60, 134.41, 134.15, 133.16, 132.87, 131.38, 129.85, 129.26, 129.09, 127.38, 127.23, 120.41, 117.62, 114.89, 55.75. HR-MS: m/z calcd for C$_{26}$H$_{16}$O$_5$:408.0998; found:408.0997.
3c 2-Benzoyl-3-(4-methylphenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione

Yellow solid, yield: 71%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.25 (d, $J = 7.6$ Hz, 1H), 8.04 (d, $J = 7.4$ Hz, 1H), 7.98 (d, $J = 7.4$ Hz, 2H), 7.74 (dt, $J = 15.8$, 7.5 Hz, 2H), 7.66 (t, $J = 8.5$ Hz, 2H), 7.61 (t, $J = 7.4$ Hz, 1H), 7.46 (t, $J = 7.7$ Hz, 2H), 7.18 (d, $J = 8.0$ Hz, 2H), 2.34 (s, 2H). $^{13}$C-NMR (101 MHz, Chloroform-d) $\delta$ 190.87, 179.72, 173.11, 157.17, 150.33, 141.37, 136.67, 134.29, 134.10, 133.89, 132.83, 132.52, 130.92, 129.79, 129.52, 128.93, 127.07, 126.92 (d, $J = 2.1$ Hz), 124.72, 118.15, 21.51. HR-MS: m/z calcd for $\text{C}_{26}\text{H}_{16}\text{O}_4$: 392.1049; found:392.1047.

3d 2-Benzoyl-3-(3-methylphenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione

Yellow solid, yield: 79%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.25 (d, $J = 7.6$ Hz, 1H), 8.04 (d, $J = 7.4$ Hz, 1H), 7.98 (d, $J = 7.7$ Hz, 2H), 7.74 (dt, $J = 22.5$, 7.4 Hz, 2H), 7.65 – 7.57 (m, 2H), 7.48 (q, $J = 8.3$, 7.7 Hz, 3H), 7.27 – 7.18 (m, 2H), 2.33 (s, 3H). $^{13}$C-NMR (101 MHz, Chloroform-d) $\delta$ 190.77, 179.67, 173.19, 157.02, 150.49, 138.94, 136.66, 134.30, 134.12, 133.95, 132.84, 132.49, 131.64, 130.85, 129.51, 128.94, 127.41 (d, $J = 7.8$ Hz), 127.10, 126.96, 124.22, 118.69, 21.38. HR-MS: m/z calcd for $\text{C}_{26}\text{H}_{16}\text{O}_4$: 392.1049; found:392,1048.

3e 2-Benzoyl-3-(4-chlorophenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione

Yellow solid, yield: 61%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.27 – 8.23 (m, 1H), 8.06 – 8.02 (m, 1H), 7.96 (d, $J = 7.3$ Hz, 2H), 7.78 (td, $J = 7.5$, 1.3 Hz, 1H), 7.72 (t, $J = 8.0$ Hz, 3H), 7.63 (t, $J = 7.4$ Hz, 1H), 7.48 (t, $J = 7.7$ Hz, 2H), 7.36 (d, $J = 8.7$ Hz, 2H). $^{13}$C-NMR (101 MHz, Chloroform-d) $\delta$ 190.86, 179.85, 173.50, 155.98, 150.97, 137.38, 136.80, 134.87, 134.55, 134.41, 133.12, 132.74, 131.09.
129.80 (d, J = 5.7 Hz), 129.37, 128.50, 127.50, 127.35, 126.28, 119.47. HR-MS: m/z calcd for C_{25}H_{13}ClO_4: 412.0502; found:412.0502.

3f 2-Benzoyl-3-(4-fluorophenyl)-4,9-dihydropatho[2,3-b]furane-4,9-dione

Yellow solid, yield: 71 %. ¹H-NMR (400 MHz, Chloroform-d) δ 8.21 (d, J = 7.5 Hz, 1H), 8.01 (d, J = 7.4 Hz, 1H), 7.97 (d, J = 7.7 Hz, 2H), 7.75 (dt, J = 10.2, 5.7 Hz, 3H), 7.69 (t, J = 7.4 Hz, 1H), 7.61 (t, J = 7.4 Hz, 1H), 7.47 (t, J = 7.6 Hz, 2H), 7.06 (t, J = 8.5 Hz, 2H). ¹³C-NMR (101 MHz, Chloroform-d) δ 190.58, 179.53, 173.10, 165.27, 162.75, 155.93, 150.50, 136.58, 134.45, 134.17, 134.01, 132.78, 132.38, 130.77, 129.50, 129.23 (d, J = 8.7 Hz), 129.00, 126.94, 123.98 – 123.64 (m), 118.56, 116.50, 116.28. HR-MS: m/z calcd for C_{25}H_{13}FO_4: 396.0798; found:396.0800.

3g 2-(2-methylphenyl)-3-phenyl-4,9-dihydropatho[2,3-b]furane-4,9-dione

Yellow solid, yield: 59%. ¹H-NMR (400 MHz, Chloroform-d) δ 8.26 – 8.22 (m, 1H), 8.05 – 8.00 (m, 1H), 7.85 – 7.79 (m, 2H), 7.75 (td, J = 7.5, 1.3 Hz, 1H), 7.70 (td, J = 7.5, 1.3 Hz, 1H), 7.53 (d, J = 7.7 Hz, 1H), 7.41 (dt, J = 5.7, 2.7 Hz, 5H), 7.13 (t, J = 7.1 Hz, 1H), 2.84 (s, 3H). ¹³C-NMR (101 MHz, Chloroform-d) δ 192.44, 179.68, 173.21, 156.56, 150.45, 140.91, 136.14, 134.06, 133.90, 132.96, 132.83, 132.45 (d, J = 3.7 Hz), 131.54, 130.77, 130.61, 129.06, 127.61, 127.07, 126.95, 125.78, 120.78, 21.82. HR-MS: m/z calcd for C_{26}H_{16}O_4: 392,1049; found:392,1051.

3h 2-(4-methylphenyl)-3-phenyl-4,9-dihydropatho[2,3-b]furane-4,9-dione

White solid, yield: 71%. ¹H-NMR (400 MHz, Chloroform-d) δ 8.25 (dd, J = 7.6, 1.1 Hz, 1H), 8.05 (dd, J = 7.5, 1.1 Hz, 1H), 7.88 (d, J = 8.2 Hz, 2H), 7.77 (ddd, J = 7.8, 6.0, 1.7 Hz, 3H), 7.71 (td, J = 7.5, 1.3 Hz, 1H), 7.42 – 7.34 (m, 3H), 7.27 (s, 1H), 7.26 (d, J = 2.4 Hz, 1H), 2.41 (s, 2H). ¹³C-NMR (101 MHz, Chloroform-d) δ 190.64, 180.03, 173.53, 156.93, 150.85, 145.89, 134.52, 134.45, 134.28, 133.18,
3i 2-(4-isopropylphenyl))-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-dione
Yellow solid, yield: 69%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.27 – 8.22 (m, 1H), 8.07 – 8.02 (m, 1H), 7.89 (d, J = 8.2 Hz, 1H), 7.76 (ddd, J = 8.8, 4.1, 2.2 Hz, 3H), 7.71 (td, J = 7.5, 1.3 Hz, 1H), 7.41 – 7.34 (m, 3H), 7.23 (d, J = 8.2 Hz, 2H), 2.52 (d, J = 7.2 Hz, 2H), 1.90 (m, J = 13.5, 6.8 Hz, 1H), 0.90 (d, J = 6.6 Hz, 6H). $^{13}$C-NMR (101 MHz, Chloroform-d) $\delta$ 190.34, 179.65, 173.19, 156.58, 150.54, 149.18, 134.43, 134.09, 133.94, 132.88, 132.49, 130.86, 130.67, 129.72, 129.56, 129.03, 127.57, 127.10, 126.94, 119.07, 45.56, 30.05, 22.40. HR-MS: m/z calcd for C$_{26}$H$_{16}$O$_4$: 392.1049; found: 392.1049.

3j 2-(4-methoxylphenyl))-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-dione
Yellow solid, yield: 80%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.25 (dd, J = 7.5, 1.1 Hz, 1H), 8.05 (dd, J = 7.5, 1.1 Hz, 1H), 7.96 (d, J = 8.8 Hz, 2H), 7.80 – 7.74 (m, 3H), 7.46 – 7.34 (m, 3H), 7.35 (d, J = 9.0 Hz, 2H), 6.95 (s, 1H). $^{13}$C-NMR (101 MHz, Chloroform-d) $\delta$ 189.06, 179.71, 173.19, 164.60, 156.42, 150.54, 149.18, 143.10, 133.94, 132.88, 132.49, 132.01, 130.79, 130.65, 129.75, 129.05, 127.58, 127.09, 126.90 (d, J = 6.9 Hz), 119.07, 114.28, 55.57. HR-MS: m/z calcd for C$_{26}$H$_{16}$O$_5$: 408.0998; found: 408.0999.
3k 2-(4-chlorophenyl)-3-phenyl-4,9-dihyronaphtho[2,3-b]furane-4,9-dione

Yellow solid, yield: 68%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.25 (d, $J = 6.8$ Hz, 1H), 8.04 (d, $J = 6.9$ Hz, 1H), 7.92 (d, $J = 8.1$ Hz, 2H), 7.80 – 7.68 (m, 4H), 7.48 – 7.35 (m, 5H). $^{13}$C-NMR (101 MHz, Chloroform-d) $\delta$ 189.48, 179.69, 173.13, 156.97, 150.62, 140.97, 135.01, 134.25, 134.05, 132.75, 132.43, 130.95, 130.83, 130.68, 129.38, 129.14, 127.33, 127.13, 127.00 (d, $J = 6.5$ Hz), 118.28. HR-MS: m/z calcd for C$_{25}$H$_{13}$ClO$_4$: 412.0502; found: 412.0502.

3l 2-(4-methylphenyl)-3-(4-methylphenyl)-4,9-dihyronaphtho[2,3-b]furane-4,9-dione

Yellow solid, yield: 71%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.27 – 8.22 (m, 1H), 8.07 – 8.02 (m, 1H), 7.87 (d, $J = 8.1$ Hz, 2H), 7.80 – 7.67 (m, 2H), 7.65 (d, $J = 8.2$ Hz, 2H), 7.27 (s, 1H), 7.25 (s, 1H), 7.17 (d, $J = 8.1$ Hz, 1H), 2.40 (s, 2H), 2.34 (s, 2H). $^{13}$C-NMR (101 MHz, Chloroform-d) $\delta$ 190.46, 179.77, 173.13, 156.98, 150.28, 145.46, 141.26, 134.25, 134.05, 132.86, 132.54, 130.93, 129.77, 129.69 (d, $J = 2.3$ Hz), 127.08, 126.89 (d, $J = 6.2$ Hz), 124.78, 118.36, 21.88, 21.51. HR-MS: m/z calcd for C$_{27}$H$_{18}$O$_4$: 406.1205; found: 406.1205.

3m 2-(4-ethylphenyl)-3-(4-methoxylphenyl)-4,9-dihyronaphtho[2,3-b]furane-4,9-dione

Yellow solid, yield: 69%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.27 – 8.22 (m, 1H), 8.07 – 8.02 (m, 1H), 7.96 (d, $J = 8.8$ Hz, 2H), 7.74 (dt, $J = 14.9, 7.5, 1.3$ Hz, 2H), 7.69 (d, $J = 8.3$ Hz, 2H), 7.20 (d, $J = 8.3$ Hz, 2H), 6.93 (d, $J = 8.9$ Hz, 2H), 3.85 (s, 3H), 2.64 (q, $J = 7.6$ Hz, 2H), 1.21 (t, $J = 7.6$ Hz, 3H). $^{13}$C-NMR (101 MHz, Chloroform-d) $\delta$ 189.24, 179.80, 173.12, 164.53, 156.82, 150.29, 147.40, ...
3n 2-(4-methylphenyl)-3-(3-methylphenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione

Yellow solid, yield: 74%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.24 (dd, J = 7.6, 1.4 Hz, 1H), 8.06 – 8.02 (m, 1H), 7.88 (d, J = 8.2 Hz, 2H), 7.73 (ddt, J = 22.1, 7.4, 1.3 Hz, 2H), 7.63 (s, 1H), 7.49 (d, J = 7.3 Hz, 1H), 7.27 (s, 1H), 7.25 (s, 1H), 7.23 – 7.16 (m, 2H), 2.40 (s, 3H), 2.33 (s, 3H).

$^{13}$C-NMR (101 MHz, Chloroform-d) $\delta$ 190.35, 179.70, 173.19, 156.82, 150.44, 145.45, 138.90, 134.26, 134.08, 133.91, 132.86, 132.51, 131.56, 130.86, 129.68 (d, J = 3.9 Hz), 128.92, 127.41 (d, J = 5.8 Hz), 127.09, 126.93, 124.17, 118.91, 21.88, 21.39. HR-MS: m/z calcd for C$_{28}$H$_{20}$O$_5$: 436.1311; found: 436.1313.

3o 2-(4-methylphenyl)-3-(4-fluorophenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione

Yellow solid, yield: 70%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.23 (d, J = 7.3 Hz, 1H), 8.04 (d, J = 7.4 Hz, 1H), 7.87 (d, J = 8.1 Hz, 2H), 7.80 – 7.73 (m, 3H), 7.71 (t, J = 7.1 Hz, 1H), 7.27 (d, J = 7.9 Hz, 2H), 7.07 (t, J = 8.6 Hz, 2H), 2.41 (s, 3H). $^{13}$C-NMR (101 MHz, Chloroform-d) $\delta$ 190.10, 179.56, 173.12, 165.24, 162.72, 155.75, 150.49, 145.62, 134.16 (d, J = 10.6 Hz), 133.95, 132.85, 132.44, 130.79, 129.69 (d, J = 9.0 Hz), 129.17 (d, J = 8.7 Hz), 127.11, 126.93, 123.91 (d, J = 2.5 Hz), 118.80, 116.46, 116.24, 21.84. HR-MS: m/z calcd for C$_{27}$H$_{18}$OF$_4$: 406.1205; found: 406.1205.
3p 2-(4-chlorophenyl)-3-(4-chlorophenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione
Yellow solid, yield: 52%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.26 (d, J = 7.5 Hz, 1H), 8.05 (d, J = 7.6 Hz, 1H), 7.90 (d, J = 8.5 Hz, 2H), 7.82 – 7.72 (m, 2H), 7.70 (d, J = 8.6 Hz, 2H), 7.44 (s, 2H), 7.38 (d, J = 8.6 Hz, 2H). HR-MS: m/z calcd for C$_{25}$H$_{12}$Cl$_2$O$_4$: 446.0113; found: 446.0116.

3q 2-(4-chlorophenyl)-3-(4-fluorophenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione
Yellow solid, yield: 63%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.27 – 8.22 (m, 1H), 8.06 – 8.02 (m, 1H), 7.90 (d, J = 8.6 Hz, 2H), 7.81 – 7.70 (m, 4H), 7.44 (d, J = 8.6 Hz, 2H), 7.10 (t, J = 8.6 Hz, 2H). $^{13}$C-NMR (101 MHz, Chloroform-d) $\delta$ 189.70, 179.95, 173.44, 165.74, 156.51, 150.92, 141.42, 135.36, 134.62, 134.44, 133.08, 132.73, 131.12, 130.96 (d, J = 3.3 Hz), 129.75, 129.66, 129.57, 127.50, 127.38, 118.41, 116.94, 116.72. HR-MS: m/z calcd for C$_{25}$H$_{12}$ClFO$_4$: 430.0408; found: 430.0408.

3r 2-(2-Naphthylcarbonyl)-3-phenyl-4,9-dihydronaphtho[2,3-b]-furane-4,9-dione
Yellow solid, yield: 74%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.28 – 8.25 (m, 1H), 8.14 (d, J = 7.9 Hz, 1H), 8.10 (dd, J = 7.4, 1.2 Hz, 1H), 7.88 (q, J = 8.1, 7.4 Hz, 4H), 7.75 (dd, J = 16.6, 7.4, 1.3 Hz, 2H), 7.69 – 7.65 (m, 1H), 7.54 (dq, J = 13.1, 6.9, 6.1 Hz, 2H), 7.47 (t, J = 7.4 Hz, 1H), 7.42 – 7.37 (m, 1H), 7.32 (t, J = 7.8 Hz, 2H). $^{13}$C-NMR (101 MHz, Chloroform-d) $\delta$ 189.46, 179.49, 173.38, 158.74, 151.54, 136.63, 134.08 (d, J = 2.9 Hz), 133.87, 133.54, 132.98, 132.29, 131.67, 131.01, 130.01, 129.82, 129.33, 128.58 (d, J = 3.3 Hz), 127.65, 127.19, 126.91, 126.58, 125.04, 124.86, 124.71, 121.79. HR-MS: m/z calcd for C$_{29}$H$_{16}$O$_4$: 428.1049; found: 428.1049.
**3s 2-Acetyl-3-phenyl-4,9-dihydronaphtho[2,3-b]furan-4,9-dione**

Yellow solid, yield: 43%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.27 – 8.22 (m, 1H), 8.21 – 8.16 (m, 1H), 7.87 – 7.82 (m, 2H), 7.81 – 7.77 (m, 2H), 7.48 (dd, J = 5.2, 1.7 Hz, 3H), 2.72 (s, 3H). $^{13}$C-NMR (101 MHz, Chloroform-d) $\delta$ 197.53, 180.29, 173.22, 156.79, 150.57, 134.24, 134.11, 132.99, 132.23, 131.06, 129.14, 129.00, 127.60 (d, J = 3.9 Hz), 127.22, 126.94, 121.41, 32.07. HR-MS: m/z calcd for C$_{20}$H$_{12}$O$_{4}$: 316.0736; found: 316.0738.

**3t 2-Phenyl-acryloyl-3-phenyl-4,9-dihydronaphtho[2,3-b]furan-4,9-dione**

Yellow solid, yield: 69%. $^1$H-NMR (500 MHz, Chloroform-d) $\delta$ 8.27 – 8.22 (m, 1H), 8.16 – 8.11 (m, 1H), 7.85 (dd, J = 6.5, 2.8 Hz, 2H), 7.81 – 7.71 (m, 2H), 7.58 – 7.48 (m, 3H), 7.46 – 7.41 (m, 3H), 7.38 (t, J = 7.8 Hz, 3H), 7.16 (d, J = 16.1 Hz, 1H). $^{13}$C-NMR (126 MHz, Chloroform-d) $\delta$ 190.37, 180.46, 173.86, 157.69, 151.32, 147.45, 134.76, 134.66 (d, J = 4.0 Hz), 133.60, 133.02, 131.78, 131.51, 130.88, 129.69, 129.57 (d, J = 9.9 Hz), 129.43, 128.19, 128.06 – 127.66 (m), 127.55, 120.22. HR-MS: m/z calcd for C$_{27}$H$_{16}$O$_{4}$: 404.1049; found: 404.1050.

**3u 2-(3-Phenyl-acryloyl)-3-p-toly-naphtho[2,3-b]furan-4,9-dione**

Yellow solid, yield: 63%. $^1$H-NMR (400 MHz, Chloroform-d) $\delta$ 8.25 (d, J = 6.2 Hz, 1H), 8.13 (d, J = 6.4 Hz, 1H), 7.85 (s, 2H), 7.76 – 7.67 (m, 2H), 7.52 (t, J = 13.1 Hz, 2H), 7.46 – 7.32 (m, 4H), 7.24 (d, J = 8.2 Hz, 1H), 7.19 – 7.05 (m, 2H), 2.35 (s, 3H). HR-MS: m/z calcd for C$_{28}$H$_{18}$O$_{4}$: 418.1205; found: 418.1204.
3v 2-[3-(4-Chloro-phenyl)-acryloyl]-3-phenyl-naphtho[2,3-b]furan-4,9-dione

Yellow solid, yield: 47%. $^1H$-NMR (400 MHz, Chloroform-d) $\delta$ 8.25 (d, J = 7.1 Hz, 1H), 8.14 (d, J = 7.0 Hz, 1H), 7.86 – 7.72 (m, 4H), 7.58 – 7.51 (m, 2H), 7.50 – 7.41 (m, 3H), 7.41 – 7.31 (m, 3H), 7.14 (t, J = 16.7 Hz, 1H). $^{13}C$-NMR (126 MHz, Chloroform-d) $\delta$ 190.09, 180.19, 173.59, 157.42, 151.05, 147.16, 145.97, 134.42 (d, J = 14.2 Hz), 133.33, 132.75, 131.50, 130.51, 129.37 (d, J = 10.5 Hz), 129.25, 129.14, 128.42, 127.59, 127.28, 121.86, 119.93. HR-MS: m/z calcd for C$_{27}$H$_{15}$ClO$_4$: 438.0659; found: 438.0660.

3w 3-<w>P</w>-Tolyl-2-(3-<w>P</w>-tolyl-acryloyl)-naphtho[2,3-b]furan-4,9-dione

Yellow solid, yield: 59%. $^1H$-NMR (400 MHz, Chloroform-d) $\delta$ 8.25 (dd, J = 7.1, 1.8 Hz, 1H), 8.13 (dd, J = 7.4, 1.4 Hz, 1H), 7.80 – 7.71 (m, 4H), 7.49 (d, J = 16.1 Hz, 1H), 7.40 (d, J = 8.1 Hz, 2H), 7.23 (d, J = 8.1 Hz, 2H), 7.17 (d, J = 8.0 Hz, 2H), 7.10 (d, J = 16.1 Hz, 1H), 2.36 (d, J = 7.8 Hz, 6H). $^{13}C$-NMR (101 MHz, Chloroform-d) $\delta$ 190.04, 179.91, 173.21, 157.32, 150.44, 147.02, 141.85, 141.42, 134.07, 133.93, 132.98, 132.44, 131.34, 130.39, 129.75 (d, J = 5.3 Hz), 128.84, 127.16 (d, J = 1.7 Hz), 126.89, 126.39, 124.80, 118.99, 21.57 (d, J = 3.4 Hz). HR-MS: m/z calcd for C$_{29}$H$_{20}$O$_4$: 432.1362; found: 432.1362.

3x 6-methoxy-2-Benzoyl-3-phenyl-4,9-dihyronaphtho[2,3-b]furane-4,9-dione

Yellow solid, yield: 81%. $^1H$-NMR (400 MHz, Chloroform-d) $\delta$ 8.17 (d, J = 8.6 Hz, 1H), 7.99 – 7.95 (m, 2H), 7.76 – 7.72 (m, 2H), 7.62 – 7.57 (m, 1H), 7.49 – 7.43 (m, 3H), 7.41 – 7.32 (m, 3H), 7.18 (dd, J = 8.6, 2.7 Hz, 1H). $^{13}C$-NMR (101 MHz, Chloroform-d) $\delta$ 190.80, 179.62, 172.64, 164.30, 156.38, 150.98, 136.69, 135.09, 134.31, 130.63, 130.42, 129.50, 129.39, 128.99 (d, J = 9.2 Hz), 127.56, 126.90, 125.68, 119.82, 118.70, 111.34, 55.95. HR-MS: m/z calcd for C$_{26}$H$_{16}$O$_5$: 408.0998; found: 408.0997.
3y 2-Benzoyl-3-phenyl-1,4-dioxa-cyclopenta[b]naphthalen-9-one

White solid, yield: 49%. 1H-NMR (400 MHz, Chloroform-d) δ 8.03 (s, 1H), 7.97 (s, 2H), 7.73 (s, 2H), 7.58 (s, 2H), 7.45 (t, 4H), 7.38 (s, 3H). 13C-NMR (101 MHz, Chloroform-d) δ 190.52, 156.49, 156.25, 154.08, 153.00, 136.82, 134.17, 131.35, 129.90, 129.71, 128.96, 128.78, 128.09, 126.55, 124.75, 121.14, 118.29, 117.52, 112.27, 111.66. HR-MS: m/z calcd for C24H14O4: 366.0892; found: 366.0890.

3z 2,3-Diphenyl-naphtho[2,3-b]furan-4,9-dione

1H-NMR (400 MHz, DMSO-d6) δ 8.19 (dd, J = 6.8, 2.2 Hz, 1H), 8.05 (dd, J = 6.9, 2.2 Hz, 1H), 7.92 (ddd, J = 6.7, 4.2, 1.9 Hz, 2H), 7.71 – 7.24 (m, 10H). 13C-NMR (101 MHz, DMSO-d6) δ 180.58, 173.35, 154.68, 151.40, 134.63, 133.63, 132.48, 130.52, 130.46, 130.42, 129.55, 129.45, 129.05, 128.98, 128.63, 127.21, 126.90, 126.59, 121.82. HR-MS: m/z calcd for C24H14O3: 350.0943; found: 350.0944. Mp: 212-213°C

3α 3-phenyl-naphtho[2,3-b]furan-4,9-dione

1H-NMR (400 MHz, DMSO-d6) δ 8.16 – 8.10 (m, 2H), 8.01 (d, J = 7.3 Hz, 2H), 7.93 – 7.87 (m, 2H), 7.74 (s, 1H), 7.55 (dt, J = 15.0, 7.0 Hz, 3H). 13C-NMR (126 MHz, Chloroform-d) δ 180.70, 172.93, 160.21, 133.88, 133.52, 132.96, 132.73, 132.30, 130.17, 128.99, 128.18, 126.84, 126.79, 125.43, 102.82. HR-MS: m/z calcd for C24H14O3: 274.0630; found: 274.0631. Mp: 238-240°C
## References


NMR spectra

$^1$H-NMR of 2-hydroxy-1,4-naphthoquinone (1a)

$^1$H-NMR of 1,3-Diphenyl-propenone (2a)
**1H-NMR of 2-Benzoyl-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3a)**

**13C-NMR of 2-Benzoyl-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3a)**
$^1$H-NMR of 3-(4-Methoxy-phenyl)-1-phenyl-propenone(2b)

$^1$H-NMR of 2-Benzoyl-3-(4-methoxylphenyl)-4,9–dihydronaphtho[2,3 - b]furane-4,9-dione(3b)
$^{13}\text{C-NMR of 2-Benzoyl-3-(4-methoxylphenyl)-4,9–dihydronaphtho[2,3 - b]furane-4,9-dione}(3b)$

$^{1}\text{H-NMR of 1-phenyl-3-p-tolyl-propenone}(2c)$
$^1$H-NMR of 2-Benzoyl-3-(4-methylphenyl)-4,9–dihydronaphtho[2,3-b]furane-4,9-dione(3c)

$^{13}$C-NMR of 2-Benzoyl-3-(4-methylphenyl)-4,9–dihydronaphtho[2,3-b]furane-4,9-dione(3c)
1H-NMR of 1-phenyl-3-m-tolyl-propenone (2d)

1H-NMR of 2-Benzoyl-3-(3-methylphenyl)-4,9-dihydronaphtho [2,3-b] furane-4,9-dione(3d)
$^{13}$C-NMR of 2-Benzoyl-3-(3-methylphenyl)-4,9-dihydronaphtho [2,3-b] furane-4,9-dione (3d)

$^1$H-NMR of 3- (4-Chlorophenyl)-1-phenyl-propenone(2e)
$^1$H-NMR of 2-Benzoyl-3-(4-chlorophenyl)-4,9-dihydronaphtho[2,3-b]furan-4,9-dione(3e)

$^{13}$C-NMR of 2-Benzoyl-3-(4-chlorophenyl)-4,9-dihydronaphtho[2,3-b]furan-4,9-dione(3e)
$^1$H-NMR of 3-(4-Fluorophenyl)-1-phenyl-propenone (2f)

$^1$H-NMR of 2-Benzoyl-3-(4-fluorophenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione (3f)
$^{13}$C-NMR of 2-Benzoyl-3-(4-fluorophenyl)-4,9-dihyronaphtho[2,3-b]furane-4,9-dione (3f)

$^1$H-NMR of 3-phenyl-1-o-tolyl-propenone (2g)
\textbf{1H-NMR of 2-(2-methylphenyl)-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3g)}

\textbf{13C-NMR of 2-(2-methylphenyl)-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3g)}
\textbf{H-NMR of 3-phenyl-1-p-tolyl-propenone(2h)}

\textbf{H-NMR of 2-(4-methylphenyl)-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3h)}
\[ 13\text{C-NMR of 2-(4-methylphenyl)-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3h)} \]

\[ 1^\text{H-NMR of 1-(4-isobutyl-phenyl)-3 phenyl –propenone(2i)} \]
$^1$H-NMR of 2-(4-isopropylphenyl))-3-phenyl-4,9-dihydronephth[2,3-b]furan-4,9-dione(3i)

$^{13}$C-NMR of 2-(4-isopropylphenyl))-3-phenyl-4,9-dihydronephth[2,3-b]furan-4,9-dione(3i)
$^1$H-NMR of 1-(4-Methoxy-phenyl)-3-phenyl-propenone (2j)

$^1$H-NMR of 2-(4-methoxyphenyl)-3-phenyl-4,9-dihydronaphtho[2,3-b]furan-4,9-dione(3j)
$^{13}$C-NMR of 2-(4-methoxylphenyl)-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3j)

$^1$H-NMR of 1- (4-Chlorophenyl)-3-phenyl-propenone (2k)
$^1$H-NMR of 2-(4-chlorophenyl)-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-dione (3k)

$^{13}$C-NMR of 2-(4-chlorophenyl)-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-dione (3k)
$^{1}$H-NMR of 1,3-Di-p-tolyl-propenone(2l)

$^{1}$H-NMR of 2-(4-methylphenyl)-3-(4-methylphenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3l)
$^1$H-NMR of 3-(4-Ethyl-phenyl)-1-(4-methoxy-phenyl)-propenone(2m)

$^{13}$C-NMR of 2-(4-methylphenyl)-3-(4-methylphenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3l)
$^1$H-NMR of 2-(4-ethylphenyl)-3-(4-methoxyphenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione (3m)

$^{13}$C-NMR of 2-(4-ethylphenyl)-3-(4-methoxyphenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione (3m)
$^1$H-NMR of 3-m-Tolyl-1-p-tolyl-propenone(2n)

$^1$H-NMR of 2-(4-methylphenyl)-3-(3-methylphenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3n)
$^{13}$C-NMR of 2-(4-methylphenyl)-3-(3-methylphenyl)-4,9-dihydrophtal[b]furane-4,9-dione(3n)

$^1$H-NMR of 3-(4-Fluoro-phenyl)-1-p-tolyl-propenone(2o)
$^1$H-NMR of 2-(4-methylphenyl)-3-(4-fluorophenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3o)

$^{13}$C-NMR of 2-(4-methylphenyl)-3-(4-fluorophenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3o)
$^1$H-NMR of 1,3-Bis-(4-chloro-phenyl)-propenone(2p)

$^1$H-NMR of 2-(4-chlorophenyl)-3-(4-chlorophenyl)-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3p)
$^1$H-NMR of 1-(4-Chloro-phenyl)-3-(4-Fluoro-phenyl)-propenone (2q)

$^1$H-NMR of 2-(4-Chlorophenyl)-3-(4-Fluorophenyl)-4,9-dihydronaphtho[2,3-b]furan-4,9-dione (3q)
$^{13}$C-NMR of 2-(4-chlorophenyl)-3-(4-fluorophenyl)-4,9-dihyronaphtho[2,3-b]furane-4,9-dione (3q)

$^1$H-NMR of 3-Naphthalen-2-phenyl-propenone (2r)
\textbf{H-NMR of 2-(2-Naphthylcarbonyl)-3-phenyl-4,9-dihydronaphtho[2,3-b]-furane-4,9-dione(3r)}

\textbf{13C-NMR of 2-(2-Naphthylcarbonyl)-3-phenyl-4,9-dihydronaphtho[2,3-b]-furane-4,9-dione(3r)}
$^1$H-NMR of 4-phenyl-but-3-en-2-one(2s)

$^1$H-NMR of 2-Acetyl-3-phenyl-4,9-dihyronaphtho[2,3-b]furane-4,9-dione(3s)
$^{13}$C-NMR of 2-Acetyl-3-phenyl-4,9-dihydrophto[2,3-b]furane-4,9-dione(3s)

$^1$H-NMR of 1,5-Diphenyl-penta-1,4-dien-3-one(2t)
$^1$H-NMR of 2-Phenyl-acryloyl-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3t)

$^{13}$C-NMR of 2-Phenyl-acryloyl-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3t)
$^1$H-NMR of 1-phenyl-5-p-tolyl-penta-1,4-dien-3-one(2u)

$^1$H-NMR of 2-Phenyl-acryloyl-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3u)
$^{13}$C-NMR of 2-Phenyl-acryloyl-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-dione(3u)

$^1$H-NMR of 1-(4-Chloro-phenyl)-5-phenyl-penta-1,4-dien-3-one(2v)
$^1$H-NMR of 2-(3-Phenyl-acryloy)-3-p-toly-naphtho[2,3-b]furan-4,9-dione(3v)

$^{13}$C-NMR of 2-(3-Phenyl-acryloy)-3-p-toly-naphtho[2,3-b]furan-4,9-dione(3v)
$^1$H-NMR of 1,5-Di-p-tolyl-penta-1,4-dien-3-one(2w)

$^1$H-NMR of 2-[3-(4-Chloro-phenyl)-acryloyl]-3-phenyl-naphtho[2,3-b]furan-4,9-dione(2w)
$^{13}$C-NMR of 2-[3-(4-Chloro-phenyl)-acryloyl]-3-phenyl-naphtho[2,3-b]furan-4,9-dione(2w)

$^1$H-NMR of 6-methoxy-2-hydroxy-1,4-naphthoquinone(1b)
$^1$H-NMR of 6-methoxy-2-Benzoyl-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-di-one

$^{13}$C-NMR of 6-methoxy-2-Benzoyl-3-phenyl-4,9-dihydronaphtho[2,3-b]furane-4,9-di-one
$^1$H-NMR of 2-Benzoyl-3-phenyl-1,4-dioxa-cyclopenta[b]naphthalen-9-one(3y)

$^{13}$C-NMR of 2-Benzoyl-3-phenyl-1,4-dioxa-cyclopenta[b]naphthalen-9-one(3y)
H-NMR of 2,3-Diphenyl-naphtho[2,3-b]furan-4,9-dione (3z)

C-NMR of 2,3-Diphenyl-naphtho[2,3-b]furan-4,9-dione (3z)
$^1$H-NMR of 3-phenyl-naphtho[2,3-b]furan-4,9-dione (3α)

$^{13}$C-NMR of 3-phenyl-naphtho[2,3-b]furan-4,9-dione (3α)