Supporting Information

Ruthenium-Catalyzed Aromatization of Aromatic Enynes via the 1,2-Migration of Halo and Aryl Groups. A New Process Involving Electrocyclization and Skeletal Rearrangement.

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(I) Experimental Procedures for Synthesis of the Substrates

(a) General Sections

Unless otherwise noted, all reactions were carried out under a nitrogen atmosphere in oven-dried glassware using standard syringe, cannula and septa apparatus. Benzene, diethyl ether, tetrahydrofuran and hexane were dried with sodium benzophenone and distilled before use. Dichloromethane was dried over CaH₂ and distilled before use. o-(ethynyl)styrenes 1-4 were prepared according to literature procedures. S¹-² All NMR spectra were run at 400 MHz (¹H NMR) or 100 MHz (¹³C NMR) in CDCl₃ solution.


(b) Typical Procedures for Synthesis of Derivatives of 1-(ethynyl)-2-(2’-iodovinyl)benzene.

To a THF solution (20 mL) of CrCl₂ (1.10 g, 9.0 mmol) was slowly added a THF solution (5 mL) of 2-(ethynyl)benzaldehyde (0.20 g, 1.5 mmol) and iodoform (1.10 g, 3.0 mmol) at 0°C in a period of 15 min. The mixtures were stirred for 3 h before it was poured into cold water (20 mL). The THF was removed in vacuo and the organic layer was extracted with diethyl ether. The etherate solution was dried over MgSO₄ and chromatographed over a silica column to give compound 5a as a colorless oil (125 mg, 0.60 mmol, 40%).
(c) Typical Procedure for Synthesis of Derivatives of 1-(ethynyl)-2-(2’-phenylvinyl)benzene (2).

To a THF solution (20 mL) of NaH (240 mg, 6.0 mmol) was added a mixture of 2-(trimethylsilylethynyl)benzaldehyde (404 mg, 2.0 mmol) and benzylphosphonic acid diethyl ester (548 mg, 2.4 mmol), and the mixture was stirred at 26 °C for 12 h. The reaction mixture was poured into cold water (20 mL). The THF was removed in vacuo and the organic layer was extracted with diethyl ether. The etherate solution was dried over MgSO₄ and chromatographed (hexane, Rf = 0.91) over a silica column to give compound S-1 as a colorless oil (436 mg, 1.58 mmol, 79 %). This silyl compound was dissolved in THF (10 mL), and added with Bu₄NF (784 mg, 3.0 mmol). The mixture was stirred at 27 °C for 10 h before addition of water (10 mL). The THF was removed under reduced pressure and extracted with diethyl ether. The etherate solution was concentrated and chromatographed on a silica column (hexane, Rf=0.86) to give enyne 2 (278 mg, 1.36 mmol, 85.6%) as a colorless oil.

(d) Standard Procedures for Catalytic Operations

A long tube containing TpRu(PPh₃)(CH₃CN)₂PF₆ (47.6 mg, 62.5 mmol) was dried vacuo for 2 h before it was charged with compound 1 (100 mg, 0.78 mmol) and toluene (0.8
mL). The mixture was heated at 110 °C for 6 h before cooling to room temperature. The solution was concentrated and eluted through a silica column (hexane/diether=5/1) to afford naphthalene 6 (95 mg, 0.74 mmol, 95%) as a colourless oil.

(e) Synthesis of $^{13}$C-enriched sample 31.

**Scheme S2**

This sample was prepared according to conventional procedures as described above. Commercially available $^{13}$C-enriched (100 atom %) dimethyl formamide (DMF) was diluted with nine-fold amount of unenriched DMF.

(II) Spectral data for compounds 1-39.

(1) Spectral data for 1-ethynyl-2-vinylbenzene (1). IR (nujol): 3296 (m), 3055 (s), 2210 (m), 1613 (s), 1475 (m); $^1$H NMR: $\delta$ 7.58 (d, $J = 6.0$ Hz, 1H ), 7.49 (d, $J = 6.0$ Hz, 1H ), 7.28 (m, 3H), 5.84 (d, $J = 17.4$ Hz, 1H), 5.40 (d, $J = 6.0$ Hz, 1H), 3.35 (s, 1H); $^{13}$C NMR : $\delta$ 138.6, 134.6, 133.0, 128.8, 127.4, 124.5, 120.7, 115.8, 81.8, 81.7, 32.9 , 30.5; HRMS (EI, m/z) calcd for C$_{10}$H$_8$: 128.0626, found: 128.0623.

(2) Spectral data for 1-ethynyl-2-styryl-benzene (2). IR (nujol): 3304 (m), 3051 (s), 2199 (m), 1610 (s), 1470 (s); $^1$H NMR: $\delta$ 7.62 (m, 2H), 7.60 (m, 3H), 7.30 (m, 6H), 3.44 (s, 1H); $^{13}$CNMR: $\delta$ 139.3, 137.2, 133.2, 130.5, 128.9, 128.6, 127.9, 127.1, 126.8,
126.3, 124.5, 121.0, 82.2, 82.0; HRMS (EI, m/z) calcd for C₁₆H₁₂: 204.0939, found: 204.0935.

(3) Spectral data for 1-(2-ethynylphenyl)-1-Methyl Styrene (3). IR (nujol, cm⁻¹):
3311(s), 3007 (w), 2120 (w), 1630 (w); HNMR (400 MHz, CDCl₃): 7.50 (d, J = 8.0 Hz, 1H), 7.19-7.32 (m, 3H), 5.23 (s, 1H) 5.12 (s, 1H), 3.19 (s, 1H), 2.17 (s, 3H); C NMR (100 MHz, CDCl₃): 141.0, 136.9, 132.7, 129.0, 128.2, 125.7, 123.5, 121.3, 82.6, 81.0, 26.6; HRMS (EI, m/z) calcd. for C₁₁H₁₀: 142.1971, Found: 142.1970.

(4) Spectral data for 1-(2-ethynyl phenyl)-1-methyl-2-n-pentyl styrene (4). IR (nujol, cm⁻¹): 3311(s), 3007(w), 2120 (w), 1635 (w); HNMR (400 MHz, CDCl₃): (isomeric ratio = 5.5) for major isomer 7.49 (d, J = 7.6 Hz, 1H ), 7.05-7.31 (m, 3H), 5.49 (t, J = 7.6 Hz , 1H), 3.08 (s, 1H), 2.00 (s, 3H, CH₃), 1.72-1.74 (m, 2H ), 1.15-1.35 (m, 6H), for minor isomer (selected peaks): 5.35 (t, J = 7.6 Hz, 1H), 3.12 (s, 1H), 2.12-2.21 (m, 2H) 0.80 (t, J = 6.8 Hz, 3H), the remaining peaks are overlapped with major isomer; C NMR (100 MHz, CDCl₃): 140.1, 134.3, 133.5, 132.8, 128.7, 128.2, 126.3, 124.5, 81.3, 81.0, 33.1, 31.4, 29.4, 28.6, 22.5, 14.0, HRMS (EI, m/z) calcd. for C₁₆H₂₀: 212.3300, Found: 212.3301.

(5) Spectral data for 1-(2-ethynyl phenyl)-2-iodo styrene (5a). IR (nujol, cm⁻¹):
3321(s), 3090 (w), 2125 (w), 1600 (w); HNMR (400 MHz, CDCl₃): (trans/cis = 1.15), for trans isomer 7.85 (d, J = 16 Hz, 1H ), 7.19-7.52 (m , 4H), 6.98 (d, J = 16 Hz, 1H), 3.33 (s, 1H), for cis isomer (selected peaks) 7.57 (d, J= 7 Hz ,1H), 6.71 (d, J=7 Hz,
1H), 3.30 (s, 1H), the remaining peaks are overlap with those of trans isomer; $^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ 142.8, 139.5, 133.2, 133.0, 129.0, 128.9, 127.9, 127.4, 125.0, 124.5, 120.0, 115.8, 82.3, 81.7, 81.5, 79.4; HRMS (EI, m/z) calcd. for C$_{10}$H$_7$I : 254.0670, found : 254.0669.

(5) **Spectral data for naphthalene (6).** IR (nujol): 3014 (s), 1593 (s); $^1$H NMR: $\delta$ 7.87 (m, 4H), 7.50 (m, 4H); $^{13}$C NMR: 133.41, 127.86, 125.8; HRMS (EI, m/z) calcd for C$_{10}$H$_8$: 128.0626, found: 128.0624.

(6) **Spectral data for 2-phenylnaphthalene (7).** IR (nujol): 3015 (s), 1601 (s). $^1$H NMR: $\delta$ 8.12 (s, 1H), 7.95 (m, 3H), 7.80 (m, 2H), 7.50 (m, 6H); $^{13}$C NMR: $\delta$ 141.1, 138.5, 133.6, 132.6, 128.8, 128.4, 128.2, 127.6, 127.4, 127.3, 126.2, 125.8, 125.7, 125.54; HRMS (EI, m/z) calcd for C$_{16}$H$_{12}$: 204.0939, found : 204.0936.

(7) **Spectral data for 1-Methyl Naphthalene (8).** IR (nujol): 3050 (w), 2920 (w), 1595 (w), 1500 (s); $^1$H NMR: $\delta$ 8.02 (d, J = 7.6 Hz, 1H), 7.87 (d, J = 7.6 Hz, 1H), 7.85 (d, J = 7.6 Hz, 1H), 7.50-7.56 (m, 2H), 7.33-7.49 (m, 2H), 2.72 (s, 3H); $^{13}$C NMR: $\delta$ 134.2, 133.5, 132.5, 128.4, 126.5, 125.6, 125.4, 124.0, 19.3; HRMS (EI, m/z) calcd. for C$_{11}$H$_{10}$: 142.1971, found: 142.1969.

(8) **Spectral data for 1-Methyl-2-n-Pentyl Naphthalene (9).** IR (neat, cm$^{-1}$): 3050 (w), 2920 (w), 1605 (w), 1510 (s); $^1$H NMR (400 MHz, CDCl$_3$): $\delta$ 8.27 (d, J = 8.0 Hz, 1H), 7.85 (d, J = 8.0 Hz, 1H), 7.63 (d, J = 8.8 Hz, 1H), 7.48 (dd, J = 8.0, 1.2 Hz, 1H), 7.42 (d,
J = 8.8 Hz, 1H), 7.28 (d, J = 8.8 Hz, 1H), 2.8 (t, J = 8.0 Hz, 2H), 2.62 (s, 3H), 1.52-1.65 (m, 2H), 1.35-1.42 (m, 4H), 0.90 (t, J = 7.6 Hz, 3H); 13C NMR (100 MHz, CDCl3) δ 138.0, 132.1, 130.4, 128.5, 128.4, 128.3, 125.7, 125.5, 124.5, 123.9, 34.4, 31.8, 30.9, 30.6, 22.6, 14.2; HRMS (EI, m/z) calcd. for C16H20: 212.3300, found: 212.3302.

(9) Spectral data for 2-Iodonaphthalene (10a). IR (nujol, cm⁻¹): 2910 (w), 2860 (w), 1620 (w), 1595 (w), 1500 (s); 1H NMR (400 MHz, CDCl3): δ 8.22 (s, 1H), 7.83 (d, J = 8.0 Hz, 1H), 7.82 (d, J = 8.0 Hz, 1H), 7.77 (d, J = 8.0 Hz, 1H), 7.67 (d, J = 8.0 Hz, 1H), 7.45-7.49 (m, 2H); 13C NMR (100 MHz, CDCl3): δ 136.5, 134.9, 134.3, 133.4, 132.0, 129.4, 126.6, 126.4, 125.7, 91.4; Mass (12 eV, m/z): 254. Anal. calcd. for C10H7I: C, 47.27; H, 2.78. Found: C, 47.37; H, 2.90.

(10) Spectral data for 3-bromo-1-deuteridonaphthalene (d-10a). IR (nujol, cm⁻¹): 2920 (w), 2860 (w), 1620 (w), 1505 (s); 1H NMR (400 MHz, CDCl3): δ 7.99 (s, 1H), 7.76-7.81 (m, 2H), 7.53 (s, 1H), 7.39-7.51 (m, 2H); 13C NMR (100 MHz, CDCl3): δ 134.4, 131.7, 129.8, 128.4, 128.4, 128.1, 127.7, 126.2, 126.0, 119.7; Mass (12 eV, m/z): 208, 210 (M⁺). Anal. calcd. for C10H6DBr: C, 57.72; H, 3.87. Found: C, 57.77; H, 3.78.

(11) Spectral data for 1-(2-Ethynyl-4-methoxy phenyl)-1-deuterido-2-iodo styrene (11a). IR (KBr, cm⁻¹): 3321 (s), 2910 (w), 2860 (w), 2125 (w), 1600 (w), 1500 (s); 1H NMR (400 MHz, CDCl3): isomeric ratio=1.2, major isomer, δ 7.31 (d, J = 8.8 Hz, 1H), 7.03 (s, 1H), 6.78-7.02 (m, 2H), 3.76 (s, 3H), 3.30 (s, 1H), minor isomer (selected peak), 7.88 (d, J = 8.8 Hz, 1H), 6.55 (s, 1H), 3.80 (s, 3H), 3.32 (s, 1H), the remaining peaks are overlapped with those of the major isomer; 13C NMR (100 MHz, CDCl3): δ 158.9, 139,
128.8, 126.3, 117.4, 116.9, 116.2, 114.7, 82.2, 82.1, 81.5, 79.9, 77.3, 55.3; Mass (12eV, m/z): 285 (M⁺). Anal. calcd. for C₁₁H₈DIO: C, 46.34; H, 3.53. Found: C, 46.32; H, 3.52.

(12) Spectral data for 1-(2-ethynyl-4-tbutyl phenyl) -2-iodo styrene (11b). IR (nujol, cm⁻¹): 3321 (s), 2910 (w), 2860 (w), 2125 (w), 1605 (w); ¹H NMR (400 MHz, CDCl₃): isomeric ratio =1.3, trans isomer δ 7.84 (d, J = 15.6 Hz, 1H), 7.54-7.58 (m, 2H), 7.47 (s, 1H), 7.37 (dd, J = 8.0, 2.0 Hz, 1H), 6.92 (d, J = 15.6, 1H), 3.30 (s, 1H), 1.31 (s, 9 H), cis isomer (selected peaks), 7.87 (d, J = 9.2 Hz, 1H), 7.32 (s, 1H), 6.63 (d, J = 9.2 Hz, 1H), 3.31 (s, 1H) 1.26 (s, 9H), the remaining peaks are overlapped with the trans isomer; ¹³C NMR (100 MHz, CDCl₃): δ 151.1, 142.5, 137.0, 136.7, 136.1, 130.0, 129.9, 127.2, 126.4, 124.8, 121.4, 119.5, 82.2, 81.7, 81.7, 81.6, 80.9, 78.4, 34.6, 30.9; Mass (12 eV, m/z): 310. Anal. calcd. for C₁₄H₁₅I : C, 54.21; H, 4.87. Found: C, 54.33; H, 4.90.

(13) Spectral data for 1-(2-ethynyl-4-methyl phenyl)-1-deuterido-2-iodo styrene (11c). IR (nujol, cm⁻¹): 2920 (w), 2860 (w), 1600 (w); ¹H NMR (400 MHz, CDCl₃): δ isomeric ratio, 1.2, major isomer δ 7.33 (s, 1H), 7.28 (d, J=8.0 Hz, 1H), 7.10 (d, J = 8.0 Hz, 1H), 6.89 (s, 1H), 3.30 (s, 1H), 2.27 (s, 3H), minor isomer (selected peaks), δ 7.78 (d, J = 8.0Hz, 1H), 7.26 (s, 1H), 7.19 (d, J = 8.0 Hz, 1H), 6.61 (s, 1H) 3.27 (s, 1H), 2.31 (s, 3H); ¹³C NMR (100 MHz, CDCl₃): δ 138.0, 138.0, 137, 136.7, 133.6, 133.4, 129.1, 127.4, 124.9, 81.8, 81.0, 78.0, 20.9; Mass (12 eV, m/z): 269. Anal. calcd. for C₁₁H₈DI: C, 49.10; H, 3.74. Found: C, 49.08; H, 3.71.
(14) Spectral data for 1-(2-ethynyl-4-fluoro phenyl)-1-deuterido-2-iodo styrene (11d).
IR (KBr, cm⁻¹): 3321 (s), 2930 (w), 2860 (w), 2140 (w), 1625 (w); \(^1\)H NMR (400 MHz, CDCl₃): isomeric ratio, 1.3, major isomer \(\delta 7.36-7.39 \text{ (m, 1H)}, 6.99-7.18 \text{ (m, 2H)}, 6.87 \text{ (s, 1H)}, 3.37 \text{ (s, 1H)}, \) minor isomer (selected peaks) \(7.81-7.85 \text{ (m, 1H)}, 6.65 \text{ (s, 1H)}, 3.34 \text{ (s, 1H)}, \) remaining peaks are overlapped with those of the major isomer; \(^{13}\)C NMR (100 MHz, CDCl₃): \(\delta 162.6 \text{ (d, } J = 47.2), 141.8, 140.6, 135.8, 132.1, 129.5, 128.4, 127.9, 126.8, 119.6, 116.6, 115.7 \text{ (d, } J=21.3), 115.0 \text{ (d, } J=21.3), 85.5, 83.3, 82.1, 80.3, 78.9; \) Mass (12 eV, m/z): 273. Anal. calcd. for C₁₀H₅DFI: C, 43.98; H, 2.58. Found: C, 43.96; H, 2.56.

(15) Spectral data for 1-(2-ethynyl-5-methoxy phenyl)-1-deuterido-2-iodo styrene (12). IR (nujol, cm⁻¹): 3311 (s), 3007 (w), 2120 (w), 1630 (w); \(^1\)H NMR (400 MHz, CDCl₃): isomeric ratio = 3, major isomer \(\delta 7.42-7.45 \text{ (m, 1H)}, 7.38 \text{ (d, } J = 8.4 \text{ Hz, 1H)}, 6.97-6.99 \text{ (m, 1H)}, 6.68-6.86 \text{ (m, 2H)}, 3.80 \text{ (s, 3H)}, 3.25 \text{ (s, 1H)}, \) minor isomer, selected peaks \(7.82 \text{ (d, } J= 8 \text{ Hz, 1H)}, 3.84 \text{ (s, 3H)}, 3.23 \text{ (s, 1H)}, \) the remaining peaks are overlapped with those of the major isomer; \(^{13}\)C NMR (100 MHz, CDCl₃): \(\delta 159.9, 159.1, 142.8, 140.8, 136.8, 134.5, 134.2, 114.4, 114.2, 112.6, 112.4, 110.1, 81.8, 81.5, 80.9, 79.6, 55.3; \) Mass (12 eV, m/z): 285. Anal. calcd. for C₁₁H₈DI0: C, 46.34; H, 3.53. Found, C, 43.96; H, 2.56.

(16) Spectral data for 1-(2-Ethynyl-4,5-methylenedioxy phenyl)-1-deuterido-2-iodo styrene (13). IR (nujol, cm⁻¹): 3321 (s), 2910 (w), 2860 (w), 2125 (w), 1600 (w), 1500 (s); \(^1\)H NMR (400 MHz, CDCl₃): isomeric ratio 1.1, major isomer, \(\delta 7.44 \text{ (s, 1H)}, 6.83 \)
(s, 1H), 6.57 (s, 1H), 6.00 (s, 2H), 3.25 (s, 1H), for minor isomer 6.92 (s, 1H), 6.84 (s, 1H), 6.74 (s, 1H), 5.96 (s, 2H), 3.26 (s, 1H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 148.7, 147.6, 147.3, 147.1, 138.5, 136.5, 135.0, 134.1, 115.7, 112.2, 111.9, 107.6, 104.3, 101.6, 81.6, 81.4, 81.1, 80.4, 80.3; Mass (12 eV, m/z) 299. Anal. calcd for C\(_{11}\)H\(_6\)DIO\(_2\): C, 44.17; H, 2.70, found: C, 44.15; H, 2.67.

(17) Spectral data for 1-(4,5-Dimethoxy-2-ethynyl phenyl)-1-deuterido-2-bromo styrene (14a). IR (nujol, cm\(^{-1}\)) : 3321 (s), 2910 (w), 2860 (w), 2125 (w), 1600 (w), 1500 (s); \(^1\)H NMR (400 MHz, CDCl\(_3\)) : isomeric ratio 1.25, major isomer \(\delta\) 6.92 (s, 1H), 6.75 (s, 1H), 6.60 (s, 1H), 3.81 (s, 3H), 3.79 (s, 3H), 3.24 (s, 1H), minor isomer (selected peaks) \(\delta\) 7.65 (s, 1H), 6.85 (s, 1H), 3.85 (s, 3H), 3.78 (s, 3H), the remaining peaks are overlapped with those of the major isomer; \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) : \(\delta\) 149.7, 148.6, 1139.8, 118.7, 114.6, 114.5, 111.0, 110.6, 107.0, 106.5, 106.0, 81.5, 80.9, 55.7; Mass (12 eV, m/z) 268, 310. Anal. calcd. for C\(_{12}\)H\(_{10}\)DBrO\(_2\): C, 53.75; H, 4.51, Found: C, 53.73; H, 4.48.

(18) Spectral data for 1-(4,5-Dimethoxy-2-ethynyl phenyl)-1-deuterido-2-iodo styrene (14b). IR (nujol, cm\(^{-1}\)) : 3325 (s), 2910 (w), 2860 (w), 2125 (w), 1600 (w), 1500 (s); \(^1\)H NMR: isomeric ratio = 1.2, major isomer, 7.59 (s, 1H), 6.89 (s, 1H), 6.81 (s, 1H), 3.89 (s, 3H), 3.88 (s, 3H), 3.27 (s, 1H), minor isomer (selected peaks), 6.97 (s, 1H), 6.83 (s, 1H), 6.55 (s, 1H), 3.94 (s, 3H), 3.85 (s, 3H), the remaining peaks are overlapped with those of the major isomer; \(^{13}\)C NMR: \(\delta\) 149.7, 148.7, 148.4, 141.7, 136.0, 133.1, 132.0,
114.7, 114.5, 112.4, 107.0, 81.5, 81.5, 80.8, 79.1, 77.3, 55.9, 55.7; Mass (12 eV, m/z) 315. Anal. calcd. for C_{12}H_{10}DIO_{2}: C, 45.74; H, 3.84. Found: C, 45.72; H, 3.81.

(19) Spectra data for 2-ethynyl 1-(1-deterido-2-Iodovinyl)-1-cyclohexne (15). IR (nujol, cm^{-1}): 2980 (w) 2870 (w), 1640 (w), 1590 (w); ^1H NMR (400 MHz, CDCl_3): isomeric ratio =1.5, major isomer 6.41 (s, 1H), 3.27 (s, 1H), 2.15-2.60 (m , 4H), δ 1.41-1.86 (m, 4H), minor isomer (selected peaks), 6.28 (s, 1H), 3.24 (s, 1H), the remaining peaks are overlap with those of the major isomer; ^13C NMR (100 MHz, CDCl_3): δ 145.0, 142.3, 141.8, 121.4, 119.7, 83.6, 83.2, 82.8, 82.6, 77.8, 30.4, 27.8, 27.3, 21.9; Mass (12 eV, m/z): 259 (M^+). Anal. calcd. for C_{10}H_{10}DI : C, 46.35; H, 4.67, found: C, 46.33; H, 4.65.

Spectra data for (1-ethynyl-4-iodo-buta-1,3-dienyl)benzene(16). IR(nujol,cm^{-1}): 3310(m), 3050(s), 2173(m), 1630(s) cm^{-1}; ^1H NMR: trans/cis ratio = 1.2, trans isomer δ 7.77~7.72 (m, 3H), 7.39~7.24 (m, 3H), 7.12 (d, J = 10 Hz, 1H), 6.60 (d, J = 8.8 Hz, 1H), 3.57 (s, 1H), cis isomer (selected peaks): δ 7.65~7.63 (m, 3H), 6.85 (d, J = 11.2Hz, 1H), 6.73 (d, J = 14.0 Hz, 1H), 3.54 (s, 1H), the remaining peaks are overlapped with those of the trans isomer; ^13C NMR: δ 143.5, 136.8, 136.6, 136.4, 135.3, 134.9, 128.5, 126.5, 126.5, 126.3, 122.6, 87.6, 86.5, 86.5, 85.8, 85.7, 84.5, 80.9; HRMS (EI, m/z) calcd for C_{12}H_{9}I: 280.1042, found: 279.9746.

(20) Spectral data for 1-(2-ethynylphenyl)-1-ethyl-2-iodo styrene (17). IR (neat, cm^{-1}): 3311(s), 3007(w), 2120 (w), 1630 (w); ^1H NMR (400 MHz, CDCl_3): isomeric ratio = 6,
major isomer, 7.48 (d, J=7.6 Hz, 1H), 7.09-7.28 (m, 3H), 6.21 (s, 1H), 3.16 (s, 1H), 2.69-2.71 (m, 2H), 0.87-0.90 (m, 3H), minor isomer (selected peaks), 7.52 (d, J=8Hz, 1H), 6.13 (s, 1H), 3.12 (s, 1H), the remaining peaks are overlapped with those of the major isomer; 13C NMR (100 MHz, CDCl3): δ 150.9, 146.5, 132.8, 132.1, 131.9, 131.4, 131.3, 130.4, 129.1, 128.8, 128.5, 128.1, 127.3, 127.0, 113.5, 82.7, 82.5, 82.3, 80.5, 80.0, 29.6, 14.1; Mass (12 eV, m/z): 282(M+). Anal. calcd. for C12H11I: C, 51.09; H, 3.33, found: C, 51.06; H, 3.91.

(21) Spectral data for 1-deuterido-3-iodo-6-methoxynaphthalen (18a). IR (nujol, cm⁻¹): 2910 (w), 2860 (w), 1600 (w), 1595 (w), 1498 (s); ¹H NMR (400 MHz, CDCl₃): δ 8.11 (s, 1H), 7.65 (d, J = 9.0 Hz, 1H), 7.55 (s, 1H), 7.12 (dd, J = 9.0, 2.4 Hz, 1H), 6.97 (d, J = 2.4 Hz, 1H), 3.88 (s, 3H); ¹³C NMR (100 MHz, CDCl₃): δ 158.8, 135.3, 134.0, 132.0, 131.4, 129.8, 129.3, 119.3, 104.6, 90.0, 55.3; Mass (12 eV, m/z) 285 (M⁺). Anal. calcd. for C₁₁H₈DIO: C, 46.34; H, 3.53. Found: C, 46.33; H, 3.52.

(22) Spectral data for 2-iodo-7-tbutylnaphthalen (18b). IR (nujol, cm⁻¹): 2910 (w), 2850 (w), 1605 (w), 1595 (w), 1500 (s); ¹H NMR: δ 8.20 (s, 1H), 7.71 (d, J = 8.8 Hz, 1H), 7.64 (d, J = 7.6 Hz, 1H), 7.63 (s, 1H), 7.57 (d, J = 7.6 Hz, 1H), 7.50 (d, J = 9.0 Hz, 1H), 1.41 (s, 9H); ¹³C NMR: δ 149.7, 136.9, 135.2, 133.9, 130.5, 129.1, 127.7, 125.6, 122.0, 91.6, 35.1, 31.3, 31.3, 31.1; Mass (12 eV, m/z) 310 (M⁺). Anal. calcd. for C₁₄H₁₅I: C, 54.21; H, 4.87. Found: C, 54.20; H, 4.84.

(23) Spectral data for 1-deuterido-3-iodo-6-methylnaphthalen (18c). IR(nujol, cm⁻¹):
2910 (w), 2860 (w), 1605 (w), 1595 (w), 1500 (s); \textsuperscript{1}H NMR (400 MHz, CDCl\textsubscript{3}): \delta 8.12 (s, 1H), 7.67 (d, J = 6.8 Hz, 1H), 7.61 (s, 1H), 7.45 (s, 1H), 7.30 (dd, J = 6.8, 1.2 Hz, 1H), 2.48 (s, 3H); \textsuperscript{13}C NMR (100 MHz, CDCl\textsubscript{3}): \delta 136.4, 135.9, 133.4, 130.2, 129.1, 128.8, 128.7, 125.8, 91.5, 21.7; Mass (12 eV, m/z): 269. Anal. calcd. for C\textsubscript{11}H\textsubscript{8}DI: C, 49.10; H, 3.74. found: C, 49.09; H, 3.72.

(24) Spectral data for 1-Deuterido-3-iodo-6-fluoronaphthalen (18d). IR (nujol, cm\textsuperscript{-1}): 2920 (w), 2860 (w), 1615 (w), 1600 (w), 1500 (s); \textsuperscript{1}H NMR (400 MHz, CDCl\textsubscript{3}): \delta 8.16 (d, J = 8.0 Hz, 1H), 7.75-7.74 (m, 1H), 7.65 (s, 1H), 7.20-7.32 (m, 2H); \textsuperscript{13}C NMR (100 MHz, CDCl\textsubscript{3}): \delta 160.7 (d, J = 245.8 Hz), 135.8, 133.6, 130.2, 129.9, 128.9, 121.0, 116.9 (d, J = 24.4), 110.0 (d, J = 24.4 Hz), 93.0; Mass (12 eV, m/z): 273 (M\textsuperscript{+}). Anal. calcd. for C\textsubscript{10}H\textsubscript{5}DFI: C, 43.98; H, 2.68. Found: C, 44.22; H, 2.66.

(25) Spectral data for 1-Deuterido-3-iodo-7-methoxynaphthalen (19). IR (KBr, cm\textsuperscript{-1}): 2910 (w), 2850 (w), 1590 (w), 1498 (s); \textsuperscript{1}HNMR (400 MHz, CDCl\textsubscript{3}): \delta 8.12 (s, 1H), 7.64 (s, 1H), 7.59 (d, J = 8.4 Hz, 1H), 7.12 (dd, J = 8.4, 2.4 Hz, 1H), 7.05 (d, J = 2.4 Hz, 1Hz), 3.89 (s, 3H); \textsuperscript{13}C NMR (100 MHz, CDCl\textsubscript{3}): \delta 157.9, 136.2, 134.6, 133.2, 131.4, 130.5, 128.3, 119.5, 105.6, 88.0, 55.3; Mass (12 eV, m/z): 285 (M\textsuperscript{+}). Anal. calcd. for C\textsubscript{11}H\textsubscript{8}DIO: C, 46.34; H, 3.53. found: C, 46.33; H, 3.51.

(26) Spectral data for 1-deuterido-3-iodo-6,7-methylenedioxy naphthalen (20). IR (nujol, cm\textsuperscript{-1}): 2910 (w), 2840 (w), 1595 (w), 1590 (w), 1498 (s); \textsuperscript{1}HNMR (400 MHz, CDCl\textsubscript{3}): \delta 7.99 (s, 1H), 7.52 (s, 1H), 7.03 (s, 1H), 6.95 (s, 1H), 6.02 (s, 2H); \textsuperscript{13}C NMR
(100 MHz, CDCl3): δ 147.9, 135.3, 135.3, 132.6, 132.6, 128.3, 128.1, 103.6, 102.7, 101.1, 89.2; Mass (12 eV, m/z): 299; Anal. calcd. for C11H6 DIO2: C, 44.17; H, 2.70, found: C, 44.15; H, 2.69.

(27) Spectral data for 1-Deuterido-3-bromo-6,7-dimethoxynaphthalen (21a). IR (nujol, cm⁻¹): 2910 (w), 2830 (w), 1595 (w), 1590 (w), 1498 (s); \(^1^H\) NMR: δ 7.80 (s, 1H), 7.37 (s, 1H), 7.04 (s, 1H), 6.99 (s, 1H), 3.96 (s, 6H); \(^1^3^C\) NMR: δ 150.0, 150.0, 130.4, 128.2, 127.7, 127.2, 124.8, 117.9, 106.1, 105.3, 55.8, 55.8; Mass (12 eV, m/z) 268, 270; Anal. calcd. for C12H10DBrO2: C, 53.75; H, 4.51. Found: C, 53.73; H, 4.50.

(28) Spectral data for 1-Deuterido-3-iodo-6,7-dimethoxynaphthalen (21b). IR (nujol, cm⁻¹): 2910 (w), 2840 (w), 1595 (w), 1590 (w), 1498 (s); \(^1^H\) NMR (400 MHz, CDCl3): δ 8.02 (s, 1H), 7.53 (s, 1H), 7.02 (s, 1H), 6.95 (s, 1H), 3.96 (s, 6H); \(^1^3^C\) NMR (100 MHz, CDCl3): δ 149.9, 149.8, 134.7, 132.4, 130.9, 127.8, 124.1, 106.1, 105.4, 88.8, 55.8, 55.8; Mass (12 eV, m/z) 315. Anal. calcd. for C12H10DIO2: C, 45.74; H, 3.84. Found: C, 45.66; H, 3.88.

(29) Spectral data for 1-deuterido-3-iodo-5,6,7,8-tetrahydro naphthalen (22). Yield 75%; IR (neat, cm⁻¹): 2980 (w), 2880 (w), 1610 (w), 1590 (w); \(^1^H\) NMR (400 MHz, CDCl3): δ 7.39 (s, 1H), 7.35 (s, 1H), 2.62-2.79 (m, 4H), 1.72-1.78 (m, 4H); \(^1^3^C\) NMR (100 MHz, CDCl3): δ 139.7, 137.7, 136.4, 134.1 130.9, 90.2, 28.9, 28.9, 22.8, 22.8; Mass (12 eV, m/z) 259. Anal. calcd. for C10H10DI: C, 46.35; H, 4.67; found: C, 46.26; H, 4.60.
Spectra data for 3-iodo-biphenyl (23). IR (nujol, cm\(^{-1}\)): 3069(s), 1650(s) cm\(^{-1}\); \(^1\)H NMR: \(\delta\) 7.92(s, 1H), 7.66 (d, J = 8.0Hz, 1H), 7.53 (d, J = 8.0Hz, 3H), 7.42 (t, J=7.2Hz, 2H), 7.36 (d, J = 7.2Hz, 1H), 7.15 (t, J = 8Hz, 1H); \(^{13}\)C NMR: \(\delta\) 143.5, 139.6, 136.2, 136.1, 130.4, 128.9, 128.9, 127.8, 127.1, 127.1, 126.4, 94.8; HRMS (EI, m/z) calcd for C\(_{12}\)H\(_9\)I: 280.1041 found: 279.9748.

(30) Spectral data for 1-ethyl-3-iodo naphthalene (24a). IR (nujol, cm\(^{-1}\)): 3050 (w), 2920 (w), 1595 (w), 1500 (s); \(^1\)H NMR (400 MHz, CDCl\(_3\)): \(\delta\) 8.08 (s, 1H), 7.86 (d, J = 8.0 Hz, 1H), 7.70 (d, J = 8.0 Hz, 1H), 7.57 (s, 1H), 7.47-7.52 (m, 2H), 3.03 (q, J = 8.0 Hz, 2H), 1.32 (t, J = 8.0 Hz, 3H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta\) 142.3, 135.3, 135.0, 133.2, 130.6, 128.5, 127.6, 126.2, 123.8, 91.7, 25.4, 14.7; Mass (12 eV, m/z): 282. Anal. calcd. for C\(_{12}\)H\(_{11}\)I: C, 51.09; H, 3.93. Found: C, 51.07; H, 3.91.

(31) Spectral data for 1-ethyl-2-iodo-naphthalene (24b). IR (nujol, cm\(^{-1}\)): 3050 (w), 2920 (w), 1595 (w), 1500 (s); \(^1\)H NMR (400 MHz, CDCl\(_3\)): \(\delta\) 8.05 (d, J = 8.0 Hz, 1H), 7.84 (d, J = 8.0 Hz, 1H), 7.70 (d, J = 7.6 Hz, 1H), 7.50 (t, J = 8.0 Hz, 1H), 7.39 (t, J = 8.0 Hz, 1H), 7.30 (d, J = 7.6 Hz, 1H), 3.09 (q, J = 7.6 Hz, 2H), 1.38 (t, J=7.6 Hz, 3H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta\) 140.2, 135.0, 133.8, 130.1, 128.7, 128.2, 127.6, 125.3, 124.8, 91.7, 25.8, 15.0; Mass (12 eV, m/z): 282. Anal. calcd. for C\(_{12}\)H\(_{11}\)I: C, 51.09; H, 3.93. Found: C, 51.01, H, 4.11.

(32) Spectral data for 1-Ethynyl-2-(4-methylstyryl)-benzene (25)
IR(nujol, cm⁻¹): 3307 (m), 3046 (s), 2197 (m), 1608 (s); ¹H NMR (CDCl₃): δ 7.69 (d, J = 8.0 Hz, 2H), 7.61 (d, J = 16.4 Hz, 1H), 7.52 (d, J = 8.0 Hz, 1H), 7.45 (d, J = 8.0 Hz, 2H), 7.34 (d, J = 8.0 Hz, 1H), 7.17 (m, 3H), 3.38 (s, 1H), 2.37 (s, 3H); ¹³C NMR: δ 139.6, 137.9, 134.5, 133.3, 130.5, 129.4, 129.0, 126.9, 126.7, 125.4, 124.4, 120.9, 82.1, 82.0, 21.3; Mass (12 eV, m/z): 218. HRMS (EI, m/z) calcd. for C₁₇H₁₄: 218.1096, found: 218.1095.

(33) Spectral data for 1-Ethynyl-2-(4-Methoxystyryl)-benzene (26).

IR (nujol, cm⁻¹): 3314 (m), 3057 (s), 2214 (m), 1615 (s), 1473 (s), 1176 (s). ¹H NMR: δ 7.66 (d, J = 8.0 Hz, 1H), 7.50 (m, 4H), 7.32 (dt, J = 6.8, 0.8 Hz, 1H), 7.17 (dt, J = 8.0, 1.2 Hz, 1H), 7.10 (d, J = 16.0 Hz, 1H), 6.90 (m, 2H), 3.82 (s, 3H), 3.38 (s, 1H); ¹³C NMR: δ 159.5, 139.6, 133.2, 130.0, 129.9, 128.9, 128.0, 126.7, 124.2, 124.1, 120.6, 114.0, 82.2, 82.0, 55.2; HRMS (EI, m/z) calcd. for C₁₇H₁₄O: 234.1045, found: 234.1047.

(34) Spectral data for 2-Ethynyl-4-methoxy-1-(2-p-tolyl-vinyl)-benzene (27).

IR (nujol, cm⁻¹): 3306 (m), 3047 (s), 2199 (m), 1604 (s), 1197 (s). ¹H NMR (CDCl₃): δ 7.61 (d, J = 8.8 Hz, 1H), 7.30 (d, J = 16.4 Hz, 1H), 7.42 (d, J = 8.0 Hz, 2H), 7.16 (d, J = 8.0 Hz, 2H), 7.01 (m, 2H), 6.91 (m, 2H), 3.80 (s, 3H), 3.37 (s, 1H), 2.35 (s, 3H); ¹³C NMR: δ 158.4, 137.4, 134.7, 132.6, 129.3, 128.5, 126.5, 125.8, 125.0, 121.7, 110.9, 116.5, 81.9, 55.4, 21.3. HRMS calcd. for C₁₈H₁₆O: 248.1201, found: 248.1200.

(35) Spectral data for 2-ethynyl-4-methoxy-1-[2-(4-methoxy-phenyl)-vinyl]-benzene (28). IR (nujol, cm⁻¹): 3317 (m), 3055 (s), 2211 (m), 1617(s), 1476(s), 1203(s); ¹H NMR:
\( \delta 7.58 \) (d, \( J = 8.4 \text{Hz}, 1\text{H} \)), 7.43 (m, 3H), 6.98 (m, 2H), 6.89 (m, 3H), 3.81 (s, 3H), 3.80 (s, 3H), 3.35 (s, 1H); \(^{13}\text{C NMR} \): \( \delta 159.3, 158.2, 132.8, 130.4, 128.1, 127.8, 125.6, 124.0, 121.6, 116.9, 116.5, 114.1, 81.8, 81.7, 55.3 \); HRMS (EI, m/z) calcd. for \( \text{C}_{18}\text{H}_{16}\text{O}_{2} \): 264.1105, found: 264.1153.

(36) Spectral data for 5-ethynyl-6-styryl-benzo[1,3]dioxole (29). IR (nujol, cm\(^{-1}\)): 3301 (m), 3051 (s), 2201 (m), 1607 (s), 1470 (s), 1207 (s); \(^{1}\text{H NMR} \): \( \delta 7.61 \) (d, \( J = 16.0 \text{Hz}, 1\text{H} \)), 7.52 (d, \( J = 7.6 \text{Hz}, 2\text{H} \)), 7.36 (m, 2H), 7.26 (m, 2H), 7.14 (s, 1H), 6.93 (s, 1H), 5.97 (s, 2H), 3.32 (s, 1H); \(^{13}\text{C NMR} \): \( \delta 148.8, 146.8, 137.3, 135.0, 128.9, 128.6, 127.7, 126.6, 126.2, 114.7, 112.0, 104.1, 104.5, 82.0, 81.0 \). HRMS (EI, m/z) calcd. for \( \text{C}_{17}\text{H}_{12}\text{O}_{2} \): 248.0837, found: 248.0839.

Spectral data for 5-Ethynyl-6-(2-p-tolyl-vinyl)-benzo[1,3]dioxole (30). IR (nujol, cm\(^{-1}\)): 3317 (m), 3055 (s), 2211 (m), 1617 (s), 1476 (s), 1203 (s); \(^{1}\text{H NMR} \): \( \delta 7.58 \) (d, \( J = 8.4 \text{Hz}, 1\text{H} \)), 7.43 (m, 3H), 6.98 (m, 2H), 6.89 (m, 3H), 3.81 (s, 3H), 3.80 (s, 3H), 3.35 (s, 1H); \(^{13}\text{C NMR} \): \( \delta 159.3, 158.2, 132.8, 130.4, 128.1, 127.8, 125.6, 124.0, 121.6, 116.9, 116.5, 114.1, 81.8, 81.7, 55.3 \); HRMS (EI, m/z) calcd. for \( \text{C}_{18}\text{H}_{16}\text{O}_{2} \): 264.1105, found: 264.1153.

Spectral data for 5-Ethynyl-6-[2-(4-methoxy-phenyl)-vinyl]-benzo-[1,3]dioxole (31). IR (nujol, cm\(^{-1}\)): 3297 (m), 3056 (s), 2211 (m), 1614 (s), 1476 (s), 1211 (s); \(^{1}\text{H NMR} \): \( \delta 7.45 \) (m, 3H), 7.11 (s, 1H), 6.90 (m, 4 H), 5.96 (s, 2H), 3.81 (s, 3H). \(^{13}\text{C NMR} \): \( \delta 159.4,
148.9, 146.6, 135.4, 130.1, 129.7, 128.5, 127.9, 124.2, 114.1, 112.1, 103.9, 101.5, 82.2, 80.8, 55.3; HRMS: Calcd for C_{18}H_{14}O_{3}: 278.0943, found: 278.0941.

Spectral data for 1-p-Tolyl-naphthalene (32A).
IR (nujol, cm\(^{-1}\)): 3021 (s), 1604 (m); \(^1\)H NMR: \(\delta\) 7.90 (m, 3H), 7.43 (m, 8H), 2.47 (s, 3H);
\(^{13}\)C NMR: \(\delta\) 140.2, 137.8, 136.9, 133.8, 131.7, 129.9, 128.9, 128.2, 127.8, 127.4, 126.9, 126.1, 125.9, 125.7, 125.4, 21.2; HRMS: calcd for C\(_{17}\)H\(_{14}\): 218.1096, found: 218.1099.

Spectral data for 2-p-Tolyl-naphthalene (32B).
IR (nujol, cm\(^{-1}\)): 3024 (s), 1604 (s); \(^1\)H NMR: \(\delta\) 8.08 (s, 1H), 7.92 (m, 3H), 7.79 (m, 1H), 7.68 (d, \(J = 8.0\) Hz, 2H), 7.53 (m, 2H), 7.34 (d, \(J = 8.0\) Hz, 2H); \(^{13}\)C NMR: \(\delta\) 138.7, 138.4, 137.3, 134.0, 132.7, 129.8, 128.6, 128.4, 128.1, 127.8, 127.4, 126.4, 126.0, 125.7, 125.6, 21.1; HRMS: Calcd for C\(_{17}\)H\(_{14}\): 218.1096, found: 218.1098.

Spectral data for 1-(4-Methoxy-phenyl)-naphthalene (33A).
IR (nujol, cm\(^{-1}\)): 3011 (s), 1501 (s), 1607 (s), 1204 (s); \(^1\)H NMR: \(\delta\) 7.89 (t, \(J = 9.6\) Hz, 2H), 7.82 (d, \(J = 8.4\) Hz, 1H), 7.44 (m, 6H), 7.03 (m, 2H), 3.88 (s, 3H); \(^{13}\)C NMR: \(\delta\) 158.9, 139.9, 133.8, 133.1, 131.8, 131.1, 128.2, 127.3, 126.9, 126.0, 125.9, 125.7, 125.4, 113.7, 55.3. HRMS: Calcd for C\(_{17}\)H\(_{14}\)O: 234.1045, found: 234.1049.

Spectral data for 2-(4-methoxy-phenyl)naphthalene (33B).
IR (nujol, cm\(^{-1}\)): 3011 (s), 1501 (s), 1607 (s), 1204 (s); \(^1\)H NMR: \(\delta\) 7.97 (s, 1H), 7.85 (m, 3H), 7.68 (m, 3H), 7.46 (m, 2H), 7.01 (m, 2H), 3.86 (s, 3H); \(^{13}\)C NMR: \(\delta\) 159.2,
138.1, 133.7, 133.6, 132.3, 128.4, 128.3, 128.0, 127.6, 126.2, 125.6, 125.4, 125.0, 114.2, 55.4; HRMS: Calcd for C_{17}H_{14}O: 234.1045, found: 234.1042.

**Spectral data for 6-methoxy-1-\(p\)-tolyl-naphthalene (34A).**

\(^1\)H NMR: \(\delta\) 7.75 (d, \(J = 9.0\) Hz, 1H), 7.67 (d, \(J = 8.4\) Hz, 1H), 7.40 (dd, \(J = 8.4, 7.2\) Hz, 1H), 7.31 (m, 2H), 7.20 (m, 3H), 7.12 (d, \(J = 2.6\) Hz, 1H), 7.01 (dd, \(J = 9.0, 2.4\) Hz, 1H), 3.87 (s, 3H), 2.38 (s, 3H); \(^{13}\)C NMR (CDCl\(_3\)): \(\delta\) 157.4, 140.2, 137.9, 136.9, 135.1, 129.9, 128.9, 127.7, 127.1, 126.3, 126.0, 124.7, 118.5, 106.0, 55.3, 21.2; IR: 3053 (s), 1604 (s), 1208 (s); HRMS: Calcd for C\(_{18}\)H\(_{16}\)O: 264.1201, found: 264.1203.

**Spectral data for 2-Methoxy-6-\(p\)-tolyl-naphthalene (34B).**

IR (nujol, cm\(^{-1}\)): 3053 (s), 1604 (s), 1208 (s); \(^1\)H NMR: \(\delta\) 7.88 (s, 1H), 7.72 (m, 2H), 7.63 (dd, \(J = 8.4, 1.2\) Hz, 1H), 7.29 (d, \(J = 7.8\) Hz, 2H), 7.20 (m, 3H), 7.10 (m, 2H), 3.87 (s, 3H), 2.34 (s, 3H); \(^{13}\)C NMR: \(\delta\) 157.6, 138.3, 136.8, 136.2, 133.6, 129.6, 129.5, 129.2, 127.2, 127.0, 126.0, 125.2, 119.1, 105.6, 55.3, 21.1. HRMS: Calcd for C\(_{18}\)H\(_{16}\)O: 264.1201, found: 264.1199.

**Spectral data for 6-methoxy-1-(4-methoxy-phenyl)-naphthalene 35A.**

IR (nujol, cm\(^{-1}\)): 3014 (s), 1608 (s), 1504 (s), 1199 (s); \(^1\)H NMR: \(\delta\) 7.75 (d, \(J = 9.0\) Hz, 1H), 7.65 (d, \(J = 8.4\) Hz, 1H), 7.39 (dd, \(J = 8.4, 2.4\) Hz, 1H), 7.36 (m, 2H), 7.19 (m, 2H), 7.12 (d, \(J = 2.4\) Hz, 1H), 7.02 (dd, \(J = 9.0, 2.4\) Hz, 1H), 6.95 (m, 2H), 3.87 (s, 3H), 3.82 (s, 3H); \(^{13}\)C NMR: \(\delta\) 158.9, 157.4, 139.9, 135.1, 133.3, 131.0, 127.7, 127.3, 126.2, 126.0, 124.8, 118.5, 113.7, 106.1, 55.4, 55.3; HRMS: Calcd for C\(_{18}\)H\(_{16}\)O\(_2\): 264.1150, found: 264.1151.
Spectral data for 2-methoxy-6-(4-methoxy-phenyl)-naphthalene 35B.
IR (nujol, cm\(^{-1}\)): 3014 (s), 1608 (s), 1504 (s), 1199 (s); \(^1\)H NMR: \(\delta\) 7.94 (s, 1H), 7.81 (dd, \(J = 8.6, 7.2\) Hz, 2H), 7.66 (d, \(J = 6.6\) Hz, 2H), 7.18 (m, 3H), 7.04 (d, \(J = 6.6\) Hz, 2H), 6.91 (d, \(J = 8.6\) Hz, 1H), 1.36 (s, 3H); \(^1\)C NMR: \(\delta\) 159.0, 157.6, 136.0, 133.8, 133.4, 129.5, 128.2, 127.4, 127.2, 125.9, 124.9, 119.1, 114.3, 105.6, 55.3; HRMS (EI, m/z) calcd. for C\(_{18}\)H\(_{16}\)O\(_2\): 264.1150, found: 264.1148.

Spectral data for 5-Phenyl-naphtho[2,3-d][1,3]dioxole 36A
IR (nujol, cm\(^{-1}\)): 3016 (s), 1606 (s), 1506 (s), 1199 (s); \(^1\)H NMR: \(\delta\) 7.60 (d, \(J = 7.8\) Hz, 1H), 7.36 (m, 6H), 7.20 (m, 1H), 7.11 (s, 2H), 5.93 (s, 2H); \(^1\)C NMR: \(\delta\) 147.8, 147.3, 141.1, 136.5, 130.9, 129.9, 128.7, 128.3, 127.2, 126.7, 125.6, 124.0, 104.1, 102.4, 101.0, 29.7; HRMS (EI, m/z) calcd. for C\(_{17}\)H\(_{12}\)O\(_2\): 248.0837, found: 248.0836.

Spectral data for 6-Phenyl-naphtho[2,3-d][1,3]dioxole 36B
IR (nujol, cm\(^{-1}\)): 3014 (s), 1608 (s), 1504 (s), 1199 (s); \(^1\)H NMR: \(\delta\) 7.78 (s, 1H), 7.60 (d, \(J = 8.4\) Hz, 1H), 7.60 (d, \(J = 8.8\) Hz, 2H), 7.51 (dd, \(J = 8.4, 1.8\) Hz, 1H), 7.40 (m, 2H ), 7.28 (t, \(J = 7.2\) Hz, 1H), 7.09 (s, 1H), 7.05 (s, 1H), 5.97 (s, 2H); \(^1\)C NMR: \(\delta\) 147.9, 147.7, 141.2, 137.2, 130.8, 126.7, 128.8, 127.4, 127.2, 127.1, 125.0, 124.0, 104.1, 103.7, 101.1; HRMS (EI, m/z) calcd. for C\(_{17}\)H\(_{12}\)O\(_2\): 248.0837, found: 248.0835.

Spectral data for 5-\(p\)-Tolyl-naphtho[2,3-d][1,3]dioxole 37A.
IR (nujol, cm\(^{-1}\)): 3016 (s), 1613 (s), 1501 (s), 1213 (s); \(^1\)H NMR: \(\delta\) 7.58 (d, \(J = 8.2\) Hz, 1H ), 7.28 (m, 3H ), 7.19 (m, 3H ), 7.13 (s, 1H ), 7.09 (s, 1H ), 5.93 (s, 2H ), 2.37 (s, 3H );
$^{13}$C NMR: δ 147.8, 147.3, 139.5, 138.2, 136.8, 130.9, 129.7, 129.0, 128.8, 125.6, 124.0, 121.2, 104.1, 102.5, 101.0, 21.2; HRMS (EI, m/z) calcd. for C$_{18}$H$_{14}$O$_2$ : 262.0994, found: 262.0991.

**Spectral data for 6-p-Tolyl-naphtho[2,3-d][1,3]dioxole 37B.**

IR (nujol, cm$^{-1}$): 3016 (s), 1613 (s), 1501 (s), 1213 (s); $^1$H NMR: δ 7.77 (s, 1H), 7.64 (d, $J$ = 8.4Hz, 1H), 7.51 (m, 3H), 7.20 (d, $J$ = 7.8Hz, 2H), 7.09 (s, 1H), 7.06 (s, 1H), 5.97 (s, 2H), 2.34 (s, 3H); $^{13}$C NMR: δ 147.9, 147.5, 138.3, 137.1, 136.9, 130.8, 129.5, 127.4, 127.1, 124.7, 123.9, 104.1, 103.7, 101.0, 21.1. HRMS (EI, m/z) calcd. for C$_{18}$H$_{14}$O$_2$ : 262.0994, found : 262.0992.

**Spectral data for 5-(4-Methoxy-phenyl)-naphtho[2,3-d][1,3]dioxole 38A.** IR (nujol, cm$^{-1}$): 3059(s), 1610(s), 1208(s); $^1$H NMR: δ 7.63 (d, $J$ = 8.5 Hz, 1H), 7.35 (m, 3H), 7.22 (m, 1H), 7.16 (s, 1H), 7.00 (s, 1H), 6.99 (d, $J$ = 1.5 Hz, 1H); $^{13}$C NMR: δ 158.8, 147.8, 147.3, 139.2, 133.5, 130.9, 128.9, 126.4, 125.6, 124.0, 113.7, 104.1, 102.4, 101.0, 55.3; HRMS (EI, m/z) calcd. for C$_{18}$H$_{14}$O$_3$ : 278.0943, found : 278.0944.