**Supporting Information for**

**Transition Metal-Free Intramolecular Friedel-Crafts Reaction by Alkene Activation: A Method for the Synthesis of Some Novel Xanthene Derivatives**

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**Experimental**

**1.General information**

The majority of the chemicals used in this work were commercially available from Merck or Aldrich. The starting compounds **1a**-**1m** were prepared by Ullmann coupling of 2-fluoro benzaldehyde and substituted phenols. The further starting compounds **2a**-**2m** were synthesized Grignard reaction of **1a**-**1m** and aryl(or alkyl)magnesium bromide. Then **3a**-**3m** were prepared from oxidation of **2a**-**2m** using PCC. The final starting alkene compounds **4a**-**4m** were obtained with Wittig reaction using Me(Ph)3PBr, *t*-BuOK, NaH. All substrates were purified by crystallization or column chromatography and were characterized by IR and GC-MS. All novel pruducts were characterized by IR, 1H-NMR, 13C-NMR, elementel analysis and GC-MS. The reactions were monitored by TLC using silica gel plates and the products were purified by flash column chromatography on silica gel (Merck; 230–400 mesh), eluting with hexane-ethyl acetate (v/v 9:1). NMR spectra were recorded at 500 MHz for 1H and 125 MHz for 13C using Me4Si as the internal standard in CDCl3. GC-MS were recorded on Shimadzu/ QP2010 Plus. IR spectra were recorded on a Mattson 1000 spectrometer. Melting points were determined with Büchi Melting Point B-540.

**2. General procedure for reduction of the Ullmann coupling:**1

To a solution of DMF (10 mL) containing 2- fluorobenzaldehyde (4 mmol) and phenol (4 mmol) was added K2CO3 (6 mmol) and the reaction mixture was stirred for 2 hours at 175 0C. It was cooled to room temperature and after usual workup and concentration, the product was purified over silica gel.

Thus, 2- arenoxybenzaldehydes were prepared in good yields with 85-95% (Scheme 1).



**Scheme 1.** The Ullmann type reaction of 2-fluorobenzaldehyde and hydroxy aryls.

**3.General procedure for Grignard reaction:**

For grignard solution, to Mg (2 mmol) was added bromo substrates (1.2 mmol) in dry THF and the mixture was heated under reflux and N2 for 0,5-1 h then cooled to room temperature. 2-arenoxybenzaldehydes (1 mmol) was solved in dry THF and cooled to 0 °C. Then grignard solution was added to aldehyde solution and stirred for 1 hours. The end of the reaction was quenched with saturated NH4Cl solution, extracted DCM and water 2 times. After usual workup and concentration, the crude was purified over silica gel.

Diarylcarbinol compounds including arenoxy group were obtained with very high yields (85-90%) (Scheme 2).



**Scheme 2.** The Grignard reaction of 2-arenoxybenzaldehyde.

**4. General procedure for Alcohol oxidation:**

To the alcohol compound (1 mmol) were added PCC (1.5 mmol) and DCM (5 ml) as solvent then stirred for 2 hours. The end of the reaction was extracted DCM and water 2 times. After usual reaction workup and concentration, the product was charged on silica gel (Scheme 3).



**Scheme 3.** The oxidation of diarylcarbinol compounds.

**5. General procedure for Wittig reaction:**

To the ketone compound (1 mmol) in dry THF were added Me(Ph)3PBr (2.2 mmol), *t*-BuOK (2.7 mmol) and NaH (2.5 mmol) and the reaction was stirred for 1-2 hours. The end of the reaction was extracted DCM and water 2 times. After usual reaction workup and concentration, the product was charged on silica gel (Scheme 4).



**Scheme 4.** Wittig reaction of ketones **3a–3m.**

**6. General procedure for intramolecular FCA of vinyl compounds**

TFA (10 mol%) was added to a stirred solution of a starting alkene compound (**4a**–**4m**) (0.1 mmol) in DCM (1 mL), and the reaction was stirred for 6-24 h under room temperature. After the finishing of the reaction, as monitored with TLC. Then the reaction was washed with water two times. After the usual reaction workup and concentration, the product was charged on silica gel.



**Scheme 5.** The intramolecular FCA of vinyl compounds **4a–4m.**

**7.Experimental Characterization Data of 4a-4m and 5a-5m**

***1-Phenoxy-2-(1-phenyl-vinyl)-benzene* 4a:**

**1H NMR** (500 MHz, CDCl3) δ 5.37 (d, *J* = 1.5 Hz, 1H), 5.63 (d, *J* = 1.5 Hz, 1H), 6.72 (d, *J* = 8.5 Hz, 1H), 6.96 − 7.01 (m, 2H), 7.17 − 7.40 (m, 10H). **13C NMR** (150MHz, CDCl3) δ 116.3, 117.9, 117.8, 119.9, 122.4, 123.7, 126.7, 127.3, 127.9, 129.0, 129.1, 129.2, 131.7, 134.0, 141.0, 146.3, 154.0, 157.4. **MS** (m/z) = 152, 165, 181, 194, 272 (M+). Anal. Calcd. for C20H16O: C, 88.20; H, 5.92. Found: C, 88.33; H, 5.93.



***1-[4-Methyl-phenoxy]-2-(1-phenyl-vinyl)-benzene* 4b:**

**1H NMR** (500 MHz, CDCl3) δ 2.30 (s, 3H), 5.40 (d, *J* = 1.5 Hz, 1H), 5.67 (d, *J* = 1.5 Hz, 1H), 6.66 (d, *J* = 8.5 Hz, 2H), 6.92 (d, *J* = 9.0 Hz, 1H), 6.95 − 7.18 (m, 4H), 7.24 − 7.39 (m, 6H). **13C NMR** (150MHz, CDCl3) δ 20.6, 116.1, 118.2, 118.3, 119.1, 119.1, 123.2, 126.7, 127.3, 128.0, 128.9, 129.8, 130.2, 131.6, 132.1, 133.6, 141.1, 146.4, 154.6, 155.0. **MS** (m/z) = 77, 105, 211, 288 (M+). Anal. Calcd. for C21H18O: C, 88.08; H, 6.34. Found: C, 88.23; H, 6.26.



***1-[2-(1-Phenyl-vinyl)-phenoxy]-naphthalene* 4c:**

**1H NMR** (500 MHz, CDCl3) δ 5.40 (d, *J* = 1.5 Hz, 1H), 5.62 (d, *J* = 1.5 Hz, 1H), 6.97 (dd, *J1* = 2.5 Hz, *J2* = 9.0 Hz, 1H), 7.05 − 7.07 (m, 1H), 7.24 − 7.32 (m, 5H), 7.35 − 7.49 (m, 6H), 7.63 − 7.88 (m, 3H). **13C NMR** (150MHz, CDCl3) δ 112.7, 114.1, 116.4, 119.1, 119.3, 120.0, 123.3, 123.4, 123.4, 124.0, 124.2, 126.3, 126.7, 127.6, 128.0, 129.1, 129.4, 129.8, 131.8, 134.1, 141.0, 146.3, 153.8, 155.3. **MS** (m/z) = 194, 215, 321, 322 (M+). Anal. Calcd. for C24H18O: C, 89.41; H, 5.63. Found: C, 89.56; H, 5.54.



***1-[4-Chloro-phenoxy]-2-(1-phenyl-vinyl)-benzene* 4d:**

**1H NMR** (500 MHz, CDCl3) δ 5.34 (d, *J* = 1.5 Hz, 1H), 5.62 (d, *J* = 1.5 Hz, 1H), 6.62 (d, *J* = 9.0 Hz, 1H), 6.96 − 6.99 (m, 1H), 7.15 (d, *J* = 9.0 Hz, 2H), 7.22 − 7.43 (m, 9H). **13C NMR** (150MHz, CDCl3) δ 116.5, 118.8, 118.9, 120.0, 120.2, 123.6, 124.3, 126.6, 127.2, 127.5, 128.0, 129.2, 129.7, 129.8, 131.8, 134.2, 140.9, 146.3, 153.4, 456.1. **MS** (m/z) = 152, 165, 181, 194, 306 (M+). Anal. Calcd. for C20H15ClO: C, 78.30; H, 4.93. Found: C, 78.48; H, 4.86.



***4-[2-(1-Phenyl-vinyl)-phenoxy]-benzonitrile* 4e:**

**1H NMR** (500 MHz, CDCl3) δ 5.29 (d, *J* = 1.0 Hz, 1H), 5.55 (d, *J* = 1.0 Hz, 1H), 6.65 (d, *J* = 1.0 Hz, 2H), 7.06 (dd, *J1* = 1.5 Hz, *J2* = 8.0 Hz, 1H), 7.13 − 7.16 (m, 2H), 7.21 − 7.27 (m, 3H), 7.32 (dd, *J1* = 1.0 Hz, *J2* = 7.5 Hz, 1H), 7.40 − 7.48 (m, 4H). **13C NMR** (150MHz, CDCl3) δ 105.0, 116.9, 117.9, 118.9, 120.4, 121.8, 125.7, 126.6, 127.6, 128.0, 129.5, 130.2, 132.1, 133.6, 134.1, 135.0, 140.5, 146.0, 151.4, 161.2. **MS (m/z) =** 152, 165, 181, 194, 296 (M+). Anal. Calcd. for C21H15NO: C, 84.82; H, 5.08; N, 4.71. Found: C, 84.75; H, 5.19; N, 4.54.



***1-[4-Fluoro-phenoxy]-2-(1-phenyl-vinyl)-benzene* 4f:**

**1H NMR** (500 MHz, CDCl3) δ 5.36 (s, 1H), 5.65 (s, 1H), 6.66 (dd, *J1* = 4.5 Hz, *J2* = 9.0 Hz, 1H), 6.88 − 6.92 (m, 2H), 6.99 − 7.07 (m, 2H), 7.21 − 7.27 (m, 1H), 7.25 − 7.41 (m, 7H). **13C NMR** (150MHz, CDCl3) δ 115.6, 115.8, 116.2, 118.2, 119.2, 119.3, 120.5, 120.5, 123.1, 123.7, 126.6, 127.4, 128.0, 129.1, 129.7, 131.8, 140.9, 146.4, 154.3, 159.2. **MS** (m/z) = 152, 165, 181, 194, 290 (M+). Anal. Calcd. for C20H15FO: C, 82.74; H, 5.21. Found: C, 82.81; H, 5.29.



***1-Phenoxy-2-(1-4-methylphenyl-vinyl)-benzene* 4g:**

**1H NMR** (500 MHz, CDCl3) δ 2.37 (s, 3H), 5.34 (d, *J* = 1.5 Hz, 1H), 5.64 (d, *J* = 1.5 Hz, 1H), 6.81 (d, *J* = 8.5 Hz, 2H), 7.00 − 7.05 (m, 2H), 7.11 − 7.12 (m, 2H), 7.19 − 7.28 (m, 5H), 7.28 − 7.33 (m, 1H), 7.40 (dd, *J1* = 1.5 Hz, *J2* = 9.0 Hz, 1H). **13C NMR** (150MHz, CDCl3) δ 21.1, 115.5, 117.9, 118.9, 120.0, 122.4, 123.7, 126.6, 128.7, 128.9, 129.3, 129.7, 131.7, 134.3, 137.1, 138.2, 146.0, 154.0, 157.6. **MS (m/z) =** 165, 178, 195, 271, 286 (M+). Anal. Calcd. for C21H18O: C, 88.08; H, 6.35. Found: C, 88.12; H, 6.29.



***1-Phenoxy-2-(1-4-methoxyphenyl-vinyl)-benzene* 4h:**

**1H NMR** (500 MHz, CDCl3) δ 3.81 (s, 3H), 5.25 (d, *J* = 1.5 Hz, 1H), 5.56 (d, *J* = 1.5 Hz, 1H), 6.80 (d, *J* = 9.0 Hz, 2H), 7.01 − 7.06 (m, 2H), 7.17 − 7.24 (m, 5H), 7.31 − 7.39 (m, 4H). **13C NMR** (150MHz, CDCl3) δ 55.2, 113.3, 114.6, 117.9, 118.8, 120.0, 122.4, 123.2, 123.7, 127.8, 128.9, 129.2, 129.7, 131.7, 133.6, 134.3, 145.6, 153.9, 157.2, 157.5, 159.1. **MS (m/z) =** 165, 211, 271, 287, 302 (M+). Anal. Calcd. for C21H18O2: C, 83.42; H, 6.00. Found: C, 83.52; H, 6.08.



***2-[1-(2-Phenoxy-phenyl)-vinyl]-naphthalene* 4i:**

**1H NMR** (500 MHz, CDCl3) δ 5.56 (d, *J* = 1.5 Hz, 1H), 5.98 (d, *J* = 1.5 Hz, 1H), 6.60 (d, *J* = 10.0 Hz, 2H), 6.92 − 7.49 (m, 14H). **13C NMR** (150MHz, CDCl3) δ 117.2, 118.8, 120.6, 120.8, 122.1, 124.0, 122.1, 124.0, 125.1, 125.3, 125.5, 126.1, 126.5, 127.4, 128.1, 128.8, 129.2, 129.7, 130.8, 144.9, 153.3, 157.4. **MS (m/z) =** 77, 115, 127, 155, 197, 231, 247, 324 (M+). Anal. Calcd. for C24H18O: C, 89.41; H, 5.63. Found: C, 89.48; H, 5.69.



***1-(1-Cyclopentyl-vinyl)-2-phenoxy-benzene* 4j:**

**IR** (cm–1) ν. **1H NMR** (500 MHz, CDCl3) δ 1.27− 1.30 (m, 8H), 1.57− 1.58 (m, 1H), 5.28 (dd, *J1* = 1.5 Hz, *J2* = 11.0 Hz, 1H), 5.79 (dd, *J1* = 1.5 Hz, *J2* = 19.0 Hz, 1H), 6.92 − 7.28 (m, 9H). **13C NMR** (150MHz, CDCl3) δ 22.6, 29.7, 31.9, 115.3, 117.7, 120.0, 119.4, 122.6, 124.0, 126.6, 128.9, 129.6, 130.0, 130.9, 135.7, 153.5, 157.8. **MS** (m/z) = 77, 93, 115, 127,169, 171, 187, 195, 250, 264 (M+). Anal. Calcd. for C19H20O: C, 86.32; H, 7.63. Found: C, 86.41; H, 7.71.



***2-[1-(2-Phenoxy-phenyl)-vinyl]-thiophene* 4k:**

**IR** (cm–1) ν. **1H NMR** (500 MHz, CDCl3) δ 5.19 (s, 1H), 5.70 (s, 1H), 6.82 (dd, *J1* = 1.0 Hz, *J2* = 3.5 Hz, 1H), 6.86 − 6.88 (m, 2H), 6.93 (dd, *J1* = 3.5 Hz, *J2* = 5.0 Hz, 1H), 6.98 (dd, *J1* = 1.0 Hz, *J2* = 8.0 Hz, 1H), 7.02 − 7.05 (m, 1H), 7.16 − 7.20 (m, 2H), 7.24 − 7.28 (m, 2H), 7.32 − 7.38 (m, 1H), 7.40 (dd, *J1* = 3.5 Hz, *J2* = 5.0 Hz, 1H). **13C NMR** (150MHz, CDCl3) δ 114.8, 118.2, 118.8, 119.6, 122.7, 123.5, 124.5, 125.5, 127.1, 129.2, 129.4, 129.7, 131.3, 133.1, 139.4, 144.9, 154.1, 157.5. **MS** (m/z) = 77, 83, 93, 127, 169, 171, 185, 201, 250, 264, 278 (M+). Anal. Calcd. for C18H14OS: C, 77.66; H, 5.07; S, 11.52. Found: C, 77.58; H, 5.12; S, 11.42.



***1-[4-Bromo-phenoxy]-2-(1-phenyl-vinyl)-benzene* 4l:**

**1H NMR** (500 MHz, CDCl3) δ 5.32 (d, 1H, *J* = 1.5 Hz), 5.60 (d, 1H, *J* = 1.5 Hz), 6.55 (d, *J* = 9.0 Hz, 1H), 6.90 (d, *J* = 9.0 Hz, 1H), 6.93 − 7.03 (dd, *J1* = 15.5 Hz, *J2* = 9.0 Hz, 2H), 7.22 − 7.38 (m, 8H), 7.44 (d, *J* = 9.0 Hz, 1H). **13C NMR** (150MHz, CDCl3) δ 116.5, 119.0, 119.2, 120.4, 124.4, 126.5, 127.5, 128.8, 129.2, 129.8, 132.1, 132.6, 134.3, 140.8, 145.2, 153.2, 156.7. **MS** (m/z) =154, 170, 179, 195, 271, 336, 350 (M+). Anal. Calcd. for C20H15BrO: C, 68.39; H, 4.30. Found: C, 68.51; H, 4.28.



***9-Methyl-9-phenyl-9H-xanthene* 5a:2**



**IR** (cm–1) ν = 3018, 2958, 1594, 1597, 1468, 1431, 1245, 1021. **1H NMR** (500 MHz, CDCl3) δ 1.96 (s, 3H), 6.87 (dd, *J1* = 2.0 Hz, *J2* = 7.5 Hz, 2H), 6.96 (ddd, *J1* = 1.5 Hz, *J2* = *J3*= 7.5 Hz, 2H), 7.13 (dd, *J1* = 1.5 Hz, *J2* = 8.0 Hz, 2H), 7.19 − 7.38 (m, 7H). **13C NMR** (150MHz, CDCl3) δ 32.1, 42.9, 116.1, 118.8, 123.0, 126.2, 127.4, 127.8, 128.0, 128.6, 128.9, 129.7, 130.0, 130.1, 149.0, 150.2, 157.2. **MS (m/z) =** 195, 257, 272 (M+). Anal. Calcd. for C20H16O: C, 88.20; H, 5.92. Found: C, 88.12; H, 5.83.

***2,9-Dimethyl-9-phenyl-9H-xanthene* 5b:**

**IR** (cm–1) ν = 3018, 2965, 2908, 1591, 1574, 1475, 1445, 1245, 750. **1H NMR** (500 MHz, CDCl3) δ 1.95 (s, 3H), 2.21 (s, 3H), 6.66 (d, *J* = 2.0 Hz, 1H), 6.85 (dd, *J1* = 1.5 Hz, *J2* = 8.0 Hz, 1H), 6.92 − 7.38 (m, 10H). **13C NMR** (150MHz, CDCl3) δ 20.8, 32.1, 42.9, 115.9, 116.1, 118.3, 119.1, 122.8, 126.1, 127.3, 128.0, 128.2, 128.6, 129.0, 129.0, 129.6, 130.2, 132.2, 148.1, 150.3, 150.3. **MS (m/z) =** 209, 286, 271 (M+). Anal. Calcd. for C21H18O: C, 88.08; H, 6.34. Found: C, 88.13; H, 6.41.



***7-Methyl-7-phenyl-7H-benzo[c]xanthene* 5c:**

**IR** (cm–1) ν = 3041, 3024, 2961, 2911, 1584, 1485, 1448, 1245, 743. **1H NMR** (500 MHz, CDCl3) δ 2.29 (s, 3H), 6.91 − 6.96 (m, 2H), 7.08 − 7.60 (m, 11H), 7.72 − 7.87 (m, 2H). **13C NMR** (150MHz, CDCl3) δ 30.3, 42.9, 114.0, 115.8, 118.1, 119.1, 119.9, 123.2, 123.4, 124.6, 125.6, 125.8, 126.0, 126.5, 127.1, 127.7, 127.8, 128.4, 128.9, 129.6, 131.4, 148.2, 150.1, 155.0. **MS (m/z) =** 245, 307, 308, 322 (M+). Anal. Calcd. for C24H18O: C, 89.41; H, 5.63. Found: C, 89.78; H, 5.71.



***2-Chloro-9-methyl-9-phenyl-9H-xanthene* 5d:**

**IR** (cm–1) ν = 3051, 3018, 2965, 2911, 1594, 1561, 1468, 1438, 1269, 1235, 750. **1H NMR** (500 MHz, CDCl3) δ 1.93 (s, 3H), 6.83 (d, *J* = 2.5 Hz, 1H), 6.84 (dd, *J1* = 2.0 Hz, *J2* = 7.5 Hz, 1H), 6.95 − 7.35 (m, 10H). **13C NMR** (150MHz, CDCl3) δ 32.1, 43.1, 116.1, 117.6, 118.9, 120.0, 123.3, 126.5, 127.6, 128.2, 128.5, 128.6, 128.9, 129.5, 129.7, 129.8, 131.0, 148.2, 148.8, 149.9. **MS (m/z) =** 51, 75, 152, 165, 181, 194, 271, 306 (M+). Anal. Calcd. for C20H15ClO: C, 78.30; H, 4.93. Found: C, 78.41; H, 4.89.



***9-Methyl-9-phenyl-9H-xanthene-2-carbonitrile* 5e:**

**IR** (cm–1) ν = 3049, 2970, 2225, 1600, 1479, 1447, 1240, 1044. **1H NMR** (500 MHz, CDCl3) δ 1.93 (s, 3H), 7.01 − 7.79 (m, 12H). **13C NMR** (150MHz, CDCl3) δ 32.5, 42.9, 105.0, 116.9, 118.9, 121.8, 124.1, 125.7, 126.6, 127.6, 128.0, 128.4, 129.0, 129.5, 132.1, 133.6, 134.0, 135.0, 146.0, 151.4, 161.2. **MS (m/z) =** 51, 77, 152, 165, 181, 194, 296 (M+). Anal. Calcd. for C21H15NO: C, 84.82; H, 5.08; N, 4.71. Found: C, 84.75; H, 5.15; N, 4.59.



***2-Fluoro-9-methyl-9-phenyl-9H-xanthene* 5f:**

**IR** (cm–1) ν = 3054, 3028, 2961, 2921, 1598, 1471, 1448, 1259, 750. **1H NMR** (500 MHz, CDCl3) δ 1.94 (s, 3H), 6.56 (dd, *J1* = 3.0 Hz, *J2* = 9.5 Hz, 1H), 6.85 (dd, *J1* = 1.5 Hz, *J2* = 8.0 Hz, 1H), 6.89 − 7.35 (m, 10H). **13C NMR** (150MHz, CDCl3) δ 31.9, 43.3, 114.4, 114.7, 114.9, 116.1, 117.3, 118.2, 120.5, 123.2, 126.5, 127.6, 128.1, 128.8, 129.2, 129.7, 148.2, 150.2, 157.5, 159.4. **MS (m/z) =** 213, 275, 290 (M+). Anal. Calcd. for C20H15FO: C, 82.74; H, 5.21. Found: C, 82.68; H, 5.28.



***9-Methyl-9-p-tolyl-9H-xanthene* 5g:**

**IR** (cm–1) ν = 3018, 2958, 2918, 1568, 1468, 1441, 1298, 1239, 746. **1H NMR** (500 MHz, CDCl3) δ 1.94 (s, 3H), 2.36 (s, 3H), 6.89 (dd, *J1* = 1.5 Hz, *J2* = 8.0 Hz, 2H), 6.99 (ddd, *J1* = 1.5 Hz, *J2* = *J3*= 7.5 Hz, 2H), 7.05 − 7.28 (m, 8H). **13C NMR** (150MHz, CDCl3) δ 20.9, 32.2, 42.5, 116.1, 118.9, 123.0, 123.2, 127.3, 128.5, 128.7, 128.9, 129.7, 130.3, 135.7, 146.1, 150.2, 157.2. **MS (m/z) =** 195, 255, 271, 286 (M+). Anal. Calcd. for C21H18O: C, 88.08; H, 6.34. Found: C, 88.13; H, 6.41.



***9-(4-Methoxy-phenyl)-9-methyl-9H-xanthene* 5h:**

**IR** (cm–1) ν = 3068, 3018, 2955, 2918, 1594, 1438, 1239, 1022, 750. **1H NMR** (500 MHz, CDCl3) δ 1.91 (s, 3H), 3.81 (s, 3H), 6.84 (d, *J* = 8.5 Hz, 1H), 6.87 (dd, *J1* = 1.5 Hz, *J2* = 8.0 Hz, 2H), 6.95 (ddd, *J1* = 1.5 Hz, *J2* = *J3*= 7.5 Hz, 2H), 7.10 (dd, *J1* = 1.5 Hz, *J2* = 8.5 Hz, 2H), 7.19 (ddd, *J1* = 1.5 Hz, *J2* = *J3*= 8.0 Hz, 2H), 7.25 (d, *J* = 8.5 Hz, 2H), 7. 28 (s, 1H). **13C NMR** (150MHz, CDCl3) δ 32.4, 42.3, 55.2, 113.2, 116.1, 123.0, 127.3, 128.9, 129.6-130.4 (10C), 141.2, 150.2, 157.7. **MS (m/z) =** 152, 165, 195, 243, 287, 302 (M+). Anal. Calcd. for C21H18O2: C, 83.42; H, 6.00. Found: C, 83.51; H, 6.08.



***9-Methyl-9-naphthalen-1-yl-9H-xanthene* 5i:**

**IR** (cm–1) ν = 3044, 2965, 1594, 1568, 1475, 1438, 1298, 1242, 743. **1H NMR** (500 MHz, CDCl3) δ 2.00 (s, 3H), 6.59 (dd, *J1* = 1.5 Hz, *J2* = 8.0 Hz, 2H), 6.78 (ddd, *J1* = 1.5 Hz, *J2* = *J3*= 7.5 Hz, 2H), 7.00 − 7.28 (m, 9H), 7.05 − 7.28 (m, 1H), 7.92 (dd, *J1* = 1.5 Hz, *J2* = 15.0 Hz, 1H). **13C NMR** (150MHz, CDCl3) δ 35.6, 43.3, 116.1, 118.9, 123.2, 113.3, 124.4, 125.0, 126.1, 127.4-129.7 (10C), 131.2, 135.2, 141.0, 149.8, 157.2. **MS** (m/z) = 153, 165, 195, 307, 322 (M+). Anal. Calcd. for C24H18O: C, 89.41; H, 5.63. Found: C, 89.54; H, 5.73.



***9-Cyclopentyl-9-methyl-9H-xanthene* 5j:**

**IR** (cm–1) ν = 3061, 3034, 2958, 2918, 1688, 1574, 1475, 1451, 1222, 1009, 796, 750. **1H NMR** (500 MHz, CDCl3) δ 1.33 − 1.39 (m, 2H), 1.56 − 1.66 (m, 6H), 1.67 (s, 3H), 2.54 (q, J = 7.5 Hz, 1H), 6.91 (dd, J1 = 1.0 Hz, J2 = 8.0 Hz, 1H), 7.08 (dd, J1 = 1.5 Hz, J2 = 8.0 Hz, 2H), 7.21 (dd, J1 = J2 = 7.5 Hz, 2H), 7.41 (dd, J1 = 7.5 Hz, J2 = 8.5 Hz, 2H), 7.53 (ddd, J1 = 2.0 Hz, J2 = J3= 8.0 Hz, 1H). **13C NMR** (150MHz, CDCl3) δ 29.3, 29.7, 30.2, 31.9, 53.4, 118.4, 119.4, 123.3, 124.3, 124.3, 128.4, 130.0, 135.7, 156.3, 159.9. **MS** (m/z) = 77, 104, 180, 189, 195, 249, 264 (M+). Anal. Calcd. for C19H20O: C, 86.32; H, 7.63. Found: C, 86.48; H, 7.76.



***9-Methyl-9-thiophen-2-yl-9H-xanthene* 5k:**

**IR** (cm–1) ν = 3064, 3024, 2958, 2915, 1598, 1468, 1431, 1235, 750. **1H NMR** (500 MHz, CDCl3) δ 2.02 (s, 3H), 6.97 (dd, *J1* = 4.0 Hz, *J2* = 5.0 Hz, 1H), 7.01 − 7.05 (m, 3H), 7.13 (ddd, *J1* =1.5 Hz, *J2* = *J3*= 8.0 Hz, 4H), 7.22 − 7.28 (m, 3H). **13C NMR** (150MHz, CDCl3) δ 33.7, 40.9, 116.3, 118.8, 123.1, 125.3-125.9 (7C), 127.9, 128.4, 129.2, 129.7, 149.7, 154.9. **MS** (m/z) = 83, 92, 110, 173, 180, 195, 264, 278 (M+). Anal. Calcd. for C18H14OS: C, 77.66; H, 5.07; S, 11.52. Found: C, 77.71; H, 5.12; S, 11.41.



***2-Bromo-9-methyl-9-phenyl-9H-xanthene* 5l:**

**IR** (cm–1) ν = 3066, 3025, 2987, 2933, 1594, 1463, 1451, 1278, 758. **1H NMR** (500 MHz, CDCl3) δ 1.93 (s, 3H), 6.89 − 6.91 (m, 3H), 7.01 − 7.03 (d, *J* = 8.5 Hz, 2H), 7.13 − 7.16 (m, 1H), 7.34 − 7.45 (m, 6H). **13C NMR** (150MHz, CDCl3) δ 29.7, 43.0, 110.3, 115.5, 119.02, 119.1, 119.9, 120.4, 123.5, 123.7, 129.8, 132.6, 132.8, 136.1, 147.7, 153.3, 156.5, 156.7. **MS (m/z) =** 78, 152, 168, 181, 257, 271, 335, 350 (M+). Anal. Calcd. for C20H15BrO: C, 68.39; H, 4.30. Found: C, 68.45; H, 4.24.



**References**

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**NMR Spectra of all the reported compounds:**

|  |
| --- |
| 4a |
| 4a |
| 4b |
| 4b |
| 4c |
| 4c |
| 4d |
| 4d |
| 4e |
| 4e |
| 4f |
| 4f |
| 4g |
| 4g |
| 4h |
| 4h |
| 4i |
| 4i |
| 4j |
| 4j |
| 4k |
| 4k |
| 4l |
|  |
| 4l    4m |
| 4m |
| 5a |
| 5a |
| 5b |
| 5b |
| 5c |
| 5c |
| 5d |
| 5d |
| 5e |
| 5e |
| 5f |
| 5f |
| 5g |
| 5g |
| 5h |
| 5h |
| 5i |
| 5i |
| 5j |
| 5j |
| 5k |
| 5k |
| 5l |
| 5l |