

Supporting Information

Xanthenones: Calixarenes-catalyzed Syntheses, Anticancer Activity and QSAR Studies

Daniel Leite da Silva,^a Bruna Silva Terra,^a Mateus Ribeiro Lage,^b Ana Lúcia Tasca Góis Ruiz,^c Cameron Capeletti da Silva,^d João Ernesto de Carvalho,^c José Walkimar de Mesquita Carneiro,^b Felipe Terra Martins,^d Sergio Antonio Fernandes,^e and Ângelo de Fátima,^{*a}

^a Grupo de Estudos em Química Orgânica e Biológica (GEQOB), Departamento de Química, ICEx, Universidade Federal de Minas Gerais, Belo Horizonte, MG, 31270-901, Brazil. Fax: +55-31-3409-5700; Tel: +55-31-3409-6373; E-mail: adefatima@qui.ufmg.br

^b Instituto de Química, Universidade Federal Fluminense, Campus do Valonguinho, Niterói, RJ, Brazil.

^c Centro Pluridisciplinar de Pesquisas Químicas, Biológicas e Agrícolas (CPQBA), Universidade Estadual de Campinas, Paulínia, SP, Brazil

^d Instituto de Química, Universidade Federal de Goiás, Goiânia, GO, Brazil

^e Grupo de Química Supramolecular e Biomimética (GQSB), Departamento de Química, Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil

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Table S1. Crystal data and structure refinement results for xanthenone **4**.

structural formula		C ₂₅ H ₂₁ F ₁ O ₂
fw (g/mol)		372.42
cryst syst		Triclinic
space group		<i>P</i> 1
<i>Z</i> / <i>Z</i> '		2 / 2
<i>T</i> (K)		150(2)
unit cell dimensions	<i>a</i> (Å)	6.0244(4)
	<i>b</i> (Å)	11.8440(9)
	<i>c</i> (Å)	13.2700(13)
	∠(°)	93.58(2)
	∠(°)	94.51(2)
	∠(°)	94.85(5)
<i>V</i> (Å ³)		938.27 (16)
calculated density (Mg/m ³)		1.318
absorption coefficient ∫ (mm ⁻¹)		0.089
<i>q</i> range for data collection (°)		3.09 – 25.68
index ranges	<i>H</i>	-7 to 6
	<i>K</i>	-14 to 14
	<i>L</i>	-16 to 16
data collected		6497
unique reflections		3497
unique reflections with <i>I</i> > 2∫(<i>I</i>)		3042
symmetry factor (<i>R</i> _{int})		0.0618
completeness to ∫ _{max} (%)		98.0
<i>F</i> (000)		392
parameters refined		509
goodness-of-fit on <i>F</i> ²		1.065
<i>R</i> ₁ factor for <i>I</i> > 2∫(<i>I</i>)		0.0788
<i>wR</i> ₂ factor for all data		0.2343
largest diff. peak / hole (e/Å ³)		0.563/-0.363
CCDC deposit number		1002985

Table S2. Selective index (SI)^a and concentration of synthesized xanthenones (GI₅₀^b in µg/mL) that elicits cancer cells^c growth inhibition by 50%.

Group	Xanthenone	U251		MCF7		NCI-ADR/RES		786-0		NCI-H460		HT-29		HaCaT
		GI ₅₀	SI	GI ₅₀	SI	GI ₅₀	SI	GI ₅₀	SI	GI ₅₀	SI	GI ₅₀	SI	GI ₅₀
1	4	186.6	0.2	203.7	0.2	2.0	16.1	3.1	10.3	36.3	0.9	>250	<0.1	32.1
1	5	56.8	0.8	92.0	0.5	0.03	1626	28.9	1.5	85.8	0.5	>250	<0.2	43.9
1	6	>250	<0.4	61.4	1.6	>250	<0.4	2.8	35.3	81.7	1.2	>250	0.4	98.9
1	7	29.8	1.8	56.9	1.0	0.77	70.3	>250	<0.2	50.5	1.1	>250	<0.2	54.1
1	8	28.5	0.9	2.0	12.9	227.9	0.1	1.7	15.1	28.7	0.9	48.2	0.5	25.7
1	9	25.6	0.9	5.2	4.5	0.7	33.3	27.1	0.9	31.4	0.7	29.9	0.8	23.3
1	10	29.5	0.8	26.5	0.9	2.6	9.4	81.8	0.3	50.7	0.5	69.6	0.4	24.4
1	11	14.0	3.8	>250	<0.2	67.5	0.8	225.4	0.2	>250	<0.2	>250	<0.2	52.9
1	12	85.6	0.6	39.6	1.2	1.7	27.9	105.2	0.5	106.9	0.4	>250	<0.19	47.5
1	13	2.9	2.1	2.6	2.3	0.4	15.2	216.0	0.03	2.8	2.2	3.2	1.9	6.1
1	14	2.9	2.0	2.7	2.1	6.7	0.9	>250	<0.02	13.1	0.4	3.2	1.8	5.8
1	15	2.9	6.9	3.9	5.2	0.3	67.0	29.8	0.7	2.6	7.7	3.4	5.9	20.1
1	16	94.0	2.7	100.3	2.5	0.4	625	197.4	1.3	119.9	2.1	>250	-	>250
1	17	187.7	1.3	132.5	1.9	6.1	41.0	>250	-	124.3	2.0	>250	-	>250
1	18	>250	-	242.4	1.0	41.9	6.0	>250	-	>250	-	>250	-	>250
1	19	164.3	1.4	39.3	6.0	>250	<0.9	>250	<0.9	183.5	1.3	>250	<0.9	235.7
1	20	6.5	4.4	21.5	1.3	8.9	3.2	20.4	1.4	19.6	1.4	16.0	1.8	28.4
1	21	84.5	2.4	127.0	1.6	51.9	3.9	246.3	0.8	>250	<0.8	>250	<0.8	204.6
1	22	76.9	0.9	31.0	2.2	9.8	6.9	>250	<0.3	104.1	0.6	199.0	0.3	67.2
1	23	35.1	1.0	82.4	0.4	0.1	341	188.3	0.2	60.3	0.6	95.9	0.4	34.1
1	24	25.1	0.6	8.8	1.8	4.4	3.5	76.6	0.2	44.2	0.3	16.2	1.0	15.4
1	25	81.8	0.8	16.0	4.3	6.7	10.4	155.7	0.4	63.0	1.1	>250	0.3	69.5
1	26	>250	-	128.9	1.9	>250	-	>250	-	>250	-	>250	-	>250
1	27	27.2	0.7	25.1	0.8	34.7	0.6	30.1	0.7	46.0	0.4	128.4	0.2	20.2
1	28	>250	<0.8	97.9	2.1	19.1	10.6	>250	<0.8	>250	<0.8	>250	<0.8	202.3
1	29	2.9	2.4	2.8	2.5	0.4	17.8	4.9	1.4	4.3	1.7	2.9	2.4	7.1
1	30	>250	-	62.6	4.0	11.5	21.7	>250	-	>250	-	165.7	1.5	>250
1	31	>250	<0.5	98.7	1.3	3.0	41.1	>250	<0.5	>250	<0.5	>250	<0.5	123.4
1	32	70.2	1.0	18.8	3.7	3.1	22.5	172.8	0.4	>250	<0.3	33.8	2.1	69.8
2	33	125.2	>2.0	29.6	>8.4	25.7	>9.7	63.5	>3.9	115.5	>2.2	>250	-	>250
2	34	189.6	>1.3	202.9	>1.2	95.1	>2.6	229.8	>1.1	>250	-	218.6	>1.1	>250
2	35	>250	-	>250	-	>250	-	>250	-	>250	-	>250	-	>250
2	36	25.2	1.1	24.4	1.1	9.3	2.9	26.2	1.0	24.3	1.1	19.4	1.4	26.6
2	37	14.2	2.8	14.0	2.9	26.4	1.5	33.4	1.2	30.9	1.3	25.7	1.6	40.4
2	38	95.3	2.6	>250	<1.0	67.1	3.7	>250	<1.0	>250	<1.0	>250	<1.0	247.8
2	39	37.2	0.3	5.7	2.3	7.2	1.8	110.3	0.1	27.8	0.5	4.9	2.6	12.9
2	40	7.17	1.4	5.4	1.9	60.3	0.2	23.2	0.4	19.4	0.5	29.1	0.3	10.0
2	41	3.4	1.2	3.0	1.3	4.9	0.8	4.0	1.0	5.0	0.8	3.5	1.1	4.0
2	42	>250	-	>250	-	>250	-	>250	-	>250	-	>250	-	>250
2	43	29.5	1.1	26.3	1.2	8.6	3.8	28.5	1.1	26.1	1.2	25.1	1.3	32.6
2	44	57.9	0.8	21.2	2.2	22.6	2.0	51.2	0.9	26.7	1.7	39.2	1.2	46.2
2	45	5.3	0.8	3.2	1.3	5.4	0.8	25.0	0.1	10.5	0.4	2.6	1.7	4.3
2	46	211.8	>1.1	>250	-	>250	-	>250	-	243.2	>1.0	>250	-	>250
2	47	25.9	1.0	25.0	1.1	24.8	1.1	53.9	0.5	25.8	1.0	26.1	1.0	26.4
2	48	0.7	1.1	0.7	1.1	0.5	1.6	2.2	0.4	2.3	0.3	0.43	1.9	0.80
2	49	3.3	0.8	2.2	1.3	1.6	1.8	7.1	0.4	7.3	0.4	2.7	1.0	2.8
2	50	32.1	2.4	21.7	3.5	10.1	7.6	81.4	0.9	75.4	1.0	118.4	0.7	77.0
2	51	32.8	1.0	52.8	0.6	27.7	1.2	83.2	0.4	28.9	1.1	28.9	1.1	32.1
2	52	>250	-	>250	-	>250	-	>250	-	>250	-	>250	-	>250
2	53	26.2	1.0	24.5	1.1	26.4	1.0	29.4	0.9	24.7	1.1	23.4	1.1	26.5
2	54	>250	<0.6	214.1	0.7	77.8	2.0	>250	<0.6	>250	<0.6	19.1	8.1	155.6
2	55	18.9	3.3	8.9	7.0	38.3	1.6	70.6	0.9	34.3	1.8	7.0	8.8	61.9
2	56	3.3	1.1	2.9	1.2	12.9	0.3	>250	<0.01	3.1	1.1	2.7	1.3	3.5
2	57	88.5	0.6	59.1	0.9	56.8	0.9	56.2	0.9	44.4	1.2	92.5	0.6	53.3
2	58	>250	-	>250	-	>250	-	>250	-	109.9	>2.3	>250	-	>250

2	59	29.1	1.0	41.8	0.7	28.0	1.0	>250	<0.1	26.8	1.1	28.5	1.0	28.2
2	60	175.3	0.6	66.1	1.6	181.7	0.6	29.4	3.5	103.0	1.0	174.0	0.6	103.5
2	61	24.6	0.4	8.1	1.3	24.3	0.4	70.6	0.2	10.7	1.0	7.5	1.4	10.7
2	62	30.0	1.0	28.3	1.0	63.4	0.5	56.2	0.5	27.8	1.0	27.7	1.1	29.2
-	Dox^d	0.03	7.4	0.06	3.4	0.05	4.0	0.04	5.3	0.01	15.4	0.08	2.4	0.2

^aSelectivity index was determined as the ratio of the GI₅₀ for HaCat to the GI₅₀ for the cancer cell line. ^bGI₅₀ values were obtained from two independent experiments, each done in triplicate. ^cU251, glioma cells; MCF7, breast; NCI-ADR/RES, multiple drug-resistant ovarian cancer cells; 786-0, renal cancer cells; NCI-H460, non-small lung cancer cells; HT-29, colon cancer cells; HaCaT, keratinocyte. ^dReference drug.

9,9-Dimethyl-12-(4-florophenyl)-8,9,10,12-tetrahydro-11H-benzo[a]xanthen-11-one (4). Yield (79%) as a white solid; mp 183-185 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.91 (1H, d, *J* = 8.0 Hz, Ar-H), 7.80-7.62 (3H, m, Ar-H), 7.48-7.20 (5H, m, Ar-H), 6.98-6.72 (3H, m, Ar-H), 5.69 (1H, s, CH), 2.50 (2H, s, CH₂), 2.26-2.17 (2H, m, CH₂), 1.06 (3H, s, CH₃), 0.91 (3H, s, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.0 (C=O), 164.1 (C), 161.3 (d, *J*_{C-F} = 244.8 Hz, C), 147.8 (C), 140.7 (d, *J*_{C-F} = 2.11 Hz, C), 131.6 (C), 131.4 (C), 130.1 (d, *J*_{C-F} = 8.1 Hz, 2xCH), 130.0 (CH), 129.1 (CH), 128.6 (CH), 127.2 (CH), 125.1 (CH), 123.6 (CH), 117.5 (C), 117.2 (CH), 115.4 (d, *J*_{C-F} = 21.1 Hz, 2xCH), 114.2 (C), 51.0 (CH₂), 41.4 (CH₂), 34.1 (C), 32.3 (CH), 29.4 (CH₃), 27.1 (CH₃); IR (KBr) (ν_{max} /cm⁻¹): 3070, 3050, 2964, 2942, 1654, 1638, 1596, 1506, 1378, 1226, 1182, 1030, 746, 538, 498; HRMS (ESI) *m/z* calcd for C₂₅H₂₁FO₂ (M+H)⁺ 373.1598, found 373.1596.

9,9-Dimethyl-12-(phenyl)-8,9,10,12-tetrahydrobenzo[a]xanthen-11-one (5). Yield (73%) as a white solid; mp 147-148 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.98 (1H, d, *J* = 7.6 Hz, Ar-H), 7.85-7.60 (2H, m, Ar-H), 7.50-7.25 (5H, m, Ar-H), 7.23-6.93 (3H, m, Ar-H), 5.70 (1H, s, CH), 2.51 (2H, s, CH₂), 2.28-2.19 (2H, m, CH₂), 1.06 (3H, s, CH₃), 0.91 (3H, s, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.0 (C=O), 164.0 (C), 147.9 (C), 144.9 (C), 131.7 (C), 131.6 (C), 129.0 (CH), 128.6 (3xCH), 128.4 (2xCH), 127.2 (CH), 126.4 (CH), 125.0 (CH), 123.8 (CH), 117.8 (C), 117.2 (CH), 114.4 (C), 51.0 (CH₂), 41.5 (CH₂), 34.9 (CH), 32.4 (C), 29.5 (CH₃), 27.3 (CH₃); IR (KBr) (ν_{max} /cm⁻¹): 3056, 3024, 2956, 2886, 2834, 1650, 1596, 1506, 1376, 1228, 1184, 1028, 808, 746, 698, 536, 512; HRMS (ESI) *m/z* calcd for C₂₅H₂₂O₂ (M+H)⁺ 355.1693, found 355.1677.

9,9-Dimethyl-12-(4-(methylthio)phenyl)-8,9,10,12-tetrahydro-11H-benzo[a]xanthen-11-one (6). Yield (68%) as a white solid; mp 167-169 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.94 (1H, d, *J* = 8.0 Hz, Ar-H), 7.82-7.58 (2H, m, Ar-H), 7.35-7.12 (m, 3H, Ar-H), 7.30 (d, 2H, *J* = 8.3 Hz, Ar-H), 7.04 (2H, d, *J* = 8.3 Hz, Ar-H), 5.65 (1H, s, CH), 2.52 (2H, s, CH₂), 2.31 (3H, s, CH₃), 2.25-2.17 (2H, m, CH₂), 1.07 (3H, s, CH₃), 0.93 (3H, s, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.1 (C=O), 164.1 (C), 147.8 (C), 142.0 (C), 136.0 (C), 131.6 (C), 131.4 (C), 129.0 (CHx3), 128.6 (CH), 127.1 (CH), 126.6 (CHx2), 125.1 (CH), 123.7 (CH), 117.6 (C), 117.2 (CH), 114.2 (C), 51.0 (CH₂), 41.5 (CH₂), 34.4 (C), 32.4 (CH), 29.4 (CH₃), 27.3 (CH₃), 15.9 (CH₃); IR (KBr) (ν_{max} /cm⁻¹): 3068, 3014, 2956, 2924, 2874, 1648, 1594, 1490, 1378, 1224, 1164, 1024, 978, 822, 748, 668, 532; HRMS (ESI) *m/z* calcd for C₂₆H₂₄SO₂ (M+H)⁺ 401.1570, found 401.1625.

9,9-Dimethyl-12-(3-methoxyphenyl)-8,9,10,12-tetrahydro-11H-benzo[a]xanthen-11-one (7). Yield (64%) as a yellow solid; mp. 194-196 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.79 (1H, d, *J* = 7.7 Hz, Ar-H), 7.72 (2H, bs, Ar-H), 7.50-7.19 (3H, m, Ar-H), 7.14-6.81 (3H, m, Ar-H), 6.57 (1H, d, *J* = 7.7 Hz, Ar-H), 5.69 (1H, s, CH), 3.67 (3H, s, CH₃), 2.52 (2H, s, CH₂), 2.24-2.18 (2H, m, CH₂), 1.07 (3H, s, CH₃), 0.94 (3H, s, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm)

197.0 (C=O), 164.1 (C), 159.6 (C), 147.9 (C), 146.5 (C), 131.6 (C), 129.3 (CH), 129.0 (CH), 128.5 (CH), 127.2 (CH), 125.0 (CH), 123.8 (2xCH), 121.0 (CH), 117.7 (C), 117.2 (C), 114.8 (CH), 114.3 (C), 111.4 (CH), 55.2 (CH₃), 51.1 (CH₂), 41.5 (CH₂), 34.8 (CH), 32.4 (C), 29.4 (CH₃), 27.4 (CH₃); IR (KBr) (ν_{\max} /cm⁻¹): 3056, 3010, 2958, 2884, 2834, 1648, 1596, 1488, 1376, 1320, 1274, 1232, 1046, 828, 752, 698, 526, 486; HRMS (ESI) m/z calcd for C₂₆H₂₄O₃ (M+H)⁺ 385.1798, found 385.1844

9,9-Dimethyl-12-(benzo[d][1,3]dioxol-5-yl)-8,9,10,12-tetrahydro-11H-benzo[a]xanthen-11-one (8). Yield (71%) as a white solid; mp 193-196 °C; ¹H NMR (200 MHz, CDCl₃): δ_{H} (ppm) 7.97 (1H, d, J = 8.0 Hz), 7.69 (2H, m, Ar-H), 7.51-7.18 (3H, m, Ar-H), 6.96-6.71 (m, 2H, Ar-H), 6.59 (2H, d, J = 8.3 Hz, Ar-H) 5.73 (2H, d, J = 8.3 Hz), 5.63 (1H, s, CH), 2.50 (2H, s, CH₂), 2.37-2.21 (2H, m, CH₂), 1.06 (3H, s, CH₃), 0.95 (3H, s, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_{C} (ppm) 197.0 (C=O), 163.0 (C), 147.8 (C), 147.6 (C), 145.9 (C), 139.0 (C), 131.6 (C), 131.5 (C), 129.0 (CH), 128.5 (CH), 127.1 (CH), 125.0 (CH), 123.8 (CH), 121.9 (CH), 117.8 (C), 117.2 (CH), 114.3 (C), 109.1 (CH), 108.0 (CH), 100.9 (CH₂), 51.0 (CH₂), 41.5 (CH₂), 34.4 (CH), 32.3 (C), 29.4 (CH₃), 27.4 (CH₃); IR (KBr) (ν_{\max} /cm⁻¹): 3064, 3058, 2960, 2878, 2776, 1644, 1596, 1488, 1438, 1378, 1296, 1226, 1036, 926, 824, 750, 672, 506, 486; HRMS (ESI) m/z calcd for C₂₆H₂₂O₄ (M+H)⁺ 399.1591, found 399.1642.

9,9-Dimethyl-12-(pyridin-2-yl)-8,9,10,12-tetrahydro-11H-benzo[a]xanthen-11-one (9). Yield (67%) as a white solid; mp 156-158 °C; ¹H NMR (200 MHz, CDCl₃): δ_{H} (ppm) 8.42 (1H, bs, Ar-H), 8.21 (1H, d, J = 7.5 Hz, Ar-H), 7.92-7.14 (7H, m, Ar-H), 6.92 (1H, bs, ArH), 5.89 (1H, s, CH), 2.61 (2H, s, CH₂), 2.45-2.06 (2H, m, CH₂), 1.12 (3H, s, CH₃), 0.99 (3H, s, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_{C} (ppm) 197.0 (C=O), 165.1 (C), 163.0 (C), 149.4 (CH), 147.7 (C), 136.2 (CH), 131.6 (C), 131.4 (C), 128.9 (CH), 128.5 (CH), 127.0 (CH), 124.9 (CH), 123.8 (CH), 123.5 (CH), 121.4 (CH), 117.5 (CH), 117.1 (C), 112.8 (C), 50.9 (CH₂), 41.5 (CH₂), 37.8 (CH), 32.4 (C), 29.6 (CH₃), 27.1 (CH₃); IR (KBr) (ν_{\max} /cm⁻¹): 3066, 3056, 3008, 2960, 2888, 1648, 1596, 1518, 1466, 1432, 1376, 1230, 1146, 1028, 856, 822, 754, 662; HRMS (ESI) m/z calcd for C₂₄H₂₁NO₂ (M+H)⁺ 356.1645, found 356.1670.

12-(4-Cyanophenyl)-9,9-dimethyl-9,10-dihydro-8H-benzo[a]xanthen-11(12H)-one (10). Yield (76%) as a white solid; mp 192-195 °C; ¹H NMR (200 MHz, CDCl₃): δ_{H} (ppm) 7.90-7.70 (3H, m, Ar-H), 7.60-7.30 (7H, m, Ar-H), 5.75 (1H, s, CH), 2.57 (2H, s, CH₂), 2.28-2.14 (2H, m, CH₂), 1.12 (3H, s, CH₃), 0.94 (3H, s, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_{C} (ppm) 196.9 (C=O), 164.7 (C), 150.0 (C), 148.0 (C), 132.4 (2xCH), 131.7 (C), 131.2 (C), 129.7 (CH), 129.4 (2xCH), 128.8 (CH), 127.5 (CH), 125.4 (CH), 123.3 (CH), 119.1 (C), 117.3 (CH), 116.3 (C), 113.3 (C), 110.3 (C), 51.0 (CH₂), 41.6 (CH₂), 35.2 (CH), 32.4 (C), 29.5 (CH₃), 27.2 (CH₃); IR (KBr) (ν_{\max} /cm⁻¹): 3080, 3068, 3046, 2956, 2932, 2874, 2230, 1662, 1646, 1502, 1466, 1402, 1372, 1332, 1224, 1142, 1016, 938, 846, 812, 754, 616; HRMS (ESI) m/z calcd for C₂₆H₂₁NO₂ (M+H)⁺ 380.1645, found 380.1679.

9,9-Dimethyl-12-(2-hydroxyphenyl)-8,9,10,12-tetrahydro-11H-benzo[a]xanthen-11-one

(11). Yield (86%) as a white solid; mp 223-225 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 9.18 (1H, s, OH), 7.66 (3H, m, Ar-H), 7.26 (3H, m, Ar-H), 6.92 (2H, bs, Ar-H), 6.52 (2H, bs, Ar-H), 5.67 (1H, s, CH), 2.51 (2H, s, CH₂), 2.41-2.22 (2H, m, CH₂), 1.05 (3H, m, CH₃), 0.89 (3H, s, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 200.9 (C=O), 167.1 (C), 153.1 (C), 148.0 (C), 132.9 (C), 131.7 (C), 131.3 (C), 129.3 (CH), 129.0 (CH), 128.5 (CH), 128.1 (CH), 127.8 (CH), 125.5 (CH), 123.7 (CH), 121.8 (CH), 119.1 (CH), 117.7 (C), 116.8 (CH), 114.1 (C), 50.5 (CH₂), 41.8 (CH₂), 32.6 (C), 29.3 (CH), 28.2 (CH₃), 27.5 (CH₃); IR (KBr) (ν_{max} /cm⁻¹): 3200, 3062, 3054, 3044, 2962, 2892, 2868, 1632, 1594, 1510, 1484, 1380, 1232, 1184, 1118, 1030, 812, 754; HRMS (ESI) *m/z* calcd for C₂₅H₂₂O₃: (M+H)⁺ 371.1642, found 371.1668.

9,9-Dimethyl-12-(naphthalen-1-yl)-8,9,10,12-tetrahydro-11H-benzo[a]xanthen-11-one

(12). Yield (80%) as a brown solid; mp 206-208 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 9.17 (1H, d, *J* = 9.0 Hz, Ar-H), 7.88 (1H, d, *J* = 8.0 Hz), 7.81-7.63 (4H, m, Ar-H), 7.60-7.43 (2H, m, Ar-H), 7.40-7.12 (5H, m, Ar-H), 6.41 (1H, s, CH), 2.58 (2H, s, CH₂), 2.19 (2H, m, CH₂), 1.01 (3H, s, CH₃), 0.89 (3H, s, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.3 (C=O), 163.9 (C), 147.8 (C), 142.9 (C), 133.8 (C), 132.0 (C), 131.6 (C), 131.1 (C), 129.0 (CH), 128.8 (CH), 128.5 (CH), 128.0 (CH), 127.4 (CH), 127.3 (CH), 126.5 (CH), 125.7 (CH), 125.6 (CH), 125.0 (CH), 124.8 (CH), 123.9 (CH), 119.7 (C), 117.4 (CH), 115.4 (C), 51.0 (CH₂), 41.7 (CH₂), 32.3 (C), 30.4 (CH), 29.5 (CH₃), 27.4 (CH₃); IR (KBr) (ν_{max} /cm⁻¹): 3052, 3032, 2956, 2870, 1646, 1620, 1596, 1516, 1400, 1370, 1220, 1176, 1144, 1068, 804, 774, 748, 654, 478; HRMS (ESI) *m/z* calcd for C₂₉H₂₄O₂ (M+H)⁺ 405.1849, found 405.1908.

9,9-Dimethyl-12-(4-hydroxyphenyl)-9,10-dihydro-8H-benzo[a]xanthen-11(12H)-one

(13). Yield (71%) as a white solid; mp 210-211 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 8.00 (d, 1H, *J* = 7.7 Hz, ArH), 7.88-7.64 (m, 2H, ArH), 7.52-7.22 (m, 4H, ArH), 7.18 (d, 2H, *J* = 8.6 Hz, ArH), 6.63 (d, 2H, *J* = 8.6 Hz, ArH), 5.64 (s, 1H, CH), 2.56 (s, 2H, CH₂), 2.41-2.10 (m, 2H, CH₂), 1.09 (s, 3H, CH₃), 0.95 (s, 3H, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 198.7 (C=O), 164.9 (C), 154.8 (C), 147.7 (C), 136.5 (C), 131.7 (C), 131.5 (C), 129.7 (2xCH), 128.9 (CH), 128.6 (CH), 127.2 (CH), 125.1 (CH), 124.0 (CH), 118.1 (C), 117.2 (CH), 115.6 (2xCH), 114.7 (C), 51.0 (CH₂), 41.6 (CH₂), 34.1 (CH), 32.6 (C), 29.4 (CH₃), 27.3 (CH₃); IR (KBr) (ν_{max} /cm⁻¹): 3350, 3222, 3060, 2954, 2936, 2890, 1652, 1596, 1512, 1466, 1374, 1230, 1146, 1028, 838, 820, 748, 616, 540. HRMS (ESI) *m/z* calcd for C₂₅H₂₂O₃ (M+H)⁺ 371.1642, found 371.1621.

9,9-Dimethyl-12-(3-hydroxyphenyl)-9,10-dihydro-8H-benzo[a]xanthen-11(12H)-one

(14). Yield (66%) as a yellow solid; mp 234-237 °C; ¹H NMR (200 MHz, DMSO-d₆): δ_H (ppm) 9.27 (bs, 1H, OH), 8.14-7.84 (m, 3H, *J* = 7.7 Hz, Ar-H), 7.62-7.36 (m, 3H, Ar-H), 7.10-6.91 (m, 1H, Ar-H), 6.88-6.62 (m, 2H, Ar-H), 6.49 (d, 1H, *J* = 7.8 Hz, Ar-H), 5.52 (s, 1H, CH), 2.79-2.56 (m, 2H, CH₂), 2.44-2.05 (m, 2H, CH₂), 1.08 (s, 3H, CH₃), 0.93 (s, 3H, CH₃); ¹³C NMR (50 MHz,

DMSO-d₆): δ_C (ppm) 196.3 (C=O), 164.1 (C), 157.5 (C), 147.6 (C), 146.6 (C), 131.4 (C), 131.1 (C), 129.4 (2xCH), 128.9 (CH), 127.6 (CH), 125.4 (CH), 123.6 (CH), 119.4 (CH), 117.8 (C), 117.5 (CH), 115.5 (CH), 113.6 (CH, C), 50.6 (CH₂), 40.7 (CH₂), 34.3 (CH), 32.3 (C), 29.2 (CH₃), 26.7 (CH₃); IR (KBr) (ν_{\max} /cm⁻¹): 3412, 3056, 2964, 2950, 2926, 2870, 1646, 1594, 1516, 1466, 1374, 1320, 1278, 1262, 1224, 1024, 866, 752, 700, 602, 530, 486; HRMS (ESI) m/z calcd for C₂₅H₂₂O₃ (M+H)⁺ 371.1642, found 371.1657.

9,9-Dimethyl-12-(4-hydroxy-3-methoxyphenyl)-9,10-dihydro-8H-benzo[a]xanthen-11(12H)-one (15). Yield (58%) as a yellow solid; mp 201-203 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.88 (d, 1H, J = 8.0 Hz, Ar-H), 7.70-7.51 (m, 2H, Ar-H), 7.42-7.09 (m, 3H, Ar-H), 6.89 (s, 1H, Ar-H), 6.56 (m, 2H, Ar-H), 5.54 (s, 1H, CH), 5.17 (bs, 1H, OH), 3.63 (s, 3H, CH₃), 2.40 (bs, 2H, CH₂), 2.15 (bs, 2H, CH₂), 0.97 (s, 3H, CH₃), 0.83 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.4 (C=O), 164.0 (C), 147.8 (C), 146.4 (C), 144.1 (C), 137.1 (C), 131.6 (2xC), 128.9 (CH), 128.5 (2xCH), 127.0 (CH), 124.9 (CH), 123.7 (CH), 117.9 (C), 117.1 (CH), 114.6 (C), 114.4 (CH), 111.6 (CH), 56.0 (CH₃), 51.0 (CH₂), 41.5 (CH₂), 34.3 (CH), 32.3 (C), 29.4 (CH₃), 27.2 (CH₃); IR (KBr) (ν_{\max} /cm⁻¹): 3356, 3044, 2952, 2871, 1643, 1596, 1481, 1324, 1270, 1228, 1042, 752, 688, 522, 481; HRMS (ESI) m/z calcd for C₂₆H₂₄O₄ (M+H)⁺ 401.1747, found 401.1758.

12-(4-Nitrophenyl)-9,10-dihydro-8H-benzo[a]xanthen-11(12H)-one (16). Yield (70%) as a yellow solid; mp 233-234 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.91 (d, 1H, J = 8.2 Hz, Ar-H), 7.81-7.57 (m, 3H, Ar-H), 7.50-7.14 (m, 5H, Ar-H), 5.72 (s, 1H, CH), 2.62 (bs, 2H, CH₂), 2.33 (bs, 2H, CH₂), 2.06-1.73 (m, 2H, CH₂); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.1 (C=O), 166.5 (C), 152.3 (C), 147.9 (C), 146.4(C), 131.7 (C), 131.1 (C), 129.8 (CH), 129.6 (2xCH), 128.8 (CH), 127.5 (CH), 125.4 (CH), 123.8 (2xCH), 123.3 (CH), 117.2 (CH), 116.2 (C), 114.3 (C), 37.1 (CH₂), 35.0 (CH), 27.9 (CH₂), 20.4 (CH₂); IR (KBr) (ν_{\max} /cm⁻¹): 3108, 3066, 2970, 2940, 2856, 1652, 1594, 1518, 1458, 1372, 1352, 1228, 1190, 1140, 1072, 1000, 948, 904, 856, 832, 744, 716, 608; HRMS (ESI) m/z calcd for C₂₄H₁₇NO₄ (M+H)⁺ 372.1230, found 372.1116.

12-(3-Methoxyphenyl)-9,10-dihydro-8H-benzo[a]xanthen-11(12H)-one (17). Yield (79%) as a yellow solid; mp 213-215 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 8.00 (d, 1H, J = 7.8 Hz, Ar-H), 7.90-7.64 (m, 2H, Ar-H), 7.54-7.22 (m, 3H, Ar-H), 7.20-7.04 (t, 1H, J = 7.2 Hz, Ar-H), 6.96 (d, 2H, J = 7.8 Hz, Ar-H), 6.63 (d, 1H, J = 8.7 Hz, Ar-H), 5.76 (s, 1H, CH), 3.73 (s, 3H, CH₃), 2.82-2.57 (m, 2H, CH₂), 2.54-2.22 (m, 2H, CH₂), 2.18-1.83 (m, 2H, CH₂); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.1 (C=O), 165.8 (C), 159.7 (C), 148.0 (C), 146.8 (C), 131.7 (2xC), 129.3 (CH), 129.0 (CH), 128.6 (CH), 127.2 (CH), 125.1 (CH), 123.9 (CH), 121.2 (CH), 117.7 (C), 117.2 (CH), 115.6 (C), 115.0 (CH), 111.4 (CH), 55.3 (CH₃), 37.2 (CH₂), 34.8 (CH), 27.9 (CH₂), 20.4 (CH₂); IR (KBr) (ν_{\max} /cm⁻¹): 3054, 3022, 2954, 2938, 2834, 1648, 1608, 1594,

1560, 1508, 1488, 1458, 1436, 1372, 1276, 1230, 1188, 1140, 1052, 1000, 952, 818, 786, 758, 696, 650, 528; HRMS (ESI) m/z calcd for $C_{24}H_{20}O_3$ (M+H)⁺ 357.1485, found 357.1400.

12-(Naphthalen-1-yl)-9,10-dihydro-8H-benzo[a]xanthen-11(12H)-one (18). Yield (81%) as a yellow solid; mp 209-210 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 9.33 (d, 1H, J = 8.5 Hz), 8.20-7.70 (m, 5H, Ar-H), 7.68-7.20 (m, 7H, Ar-H), 6.55 (s, 1H, CH), 2.91-2.60 (m, 2H, CH₂), 2.51-2.23 (m, 2H, CH₂), 2.10-1.65 (m, 2H, CH₂); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.3 (C=O), 165.7 (C), 147.8 (C), 143.1 (C), 133.7 (C), 131.8 (C), 131.5 (C), 131.0 (C), 128.8 (CH), 128.7 (CH), 128.5 (CH), 127.9 (CH), 127.3 (CH), 127.2 (CH), 126.4 (CH), 125.7 (CH), 125.6 (CH), 124.9 (CH), 124.8 (CH), 123.8 (CH), 119.8 (C), 117.2 (CH), 116.6 (C), 37.1 (CH₂), 30.4 (CH), 28.0 (CH₂), 27.3 (CH₂); IR (KBr) (ν_{max} /cm⁻¹): 3060, 3032, 2964, 2932, 1652, 1618, 1594, 1510, 1452, 1372, 1250, 1228, 1188, 1070, 1030, 998, 950, 832, 804, 780, 752, 650, 530, 458; HRMS (ESI) m/z calcd for $C_{27}H_{20}O_2$ (M+H)⁺ 377.1536, found 377.1522.

12-(Naphthalen-2-yl)-9,10-dihydro-8H-benzo[a]xanthen-11(12H)-one (19). Yield (84%) as a yellow solid; mp 190-191 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 8.11 (d, 1H, J = 7.8 Hz, Ar-H), 8.00-7.70 (m, 6H, Ar-H), 7.65-7.20 (m, 6H, Ar-H), 6.02 (s, 1H, CH), 2.88-2.60 (m, 2H, CH₂), 2.50-2.20 (m, 2H, CH₂), 2.10-1.55 (m, 2H, CH₂); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.2 (C=O), 165.8 (C), 147.9 (C), 142.6 (C), 133.4 (C), 132.2 (C), 131.6 (C), 131.5 (C), 129.1 (CH), 128.5 (CH), 128.2 (CH), 128.1 (CH), 127.6 (CH), 127.3 (CH), 127.2 (CH), 126.9 (CH), 125.9 (CH), 125.6 (CH), 125.0 (CH), 123.8 (CH), 117.6 (C), 117.1 (CH), 115.4 (C), 37.1 (CH₂), 35.0 (CH), 27.8 (CH₂), 20.3 (CH₂); IR (KBr) (ν_{max} /cm⁻¹): 3054, 3020, 2934, 2886, 1652, 1618, 1596, 1508, 1458, 1400, 1374, 1230, 1194, 1144, 1072, 998, 956, 858, 820, 748, 648, 530, 480; HRMS (ESI) m/z calcd for $C_{27}H_{20}O_2$ (M+H)⁺ 377.1536, found 377.1518.

12-(4-(Methylthio)phenyl)-8,9,10,12-tetrahydro-11H-benzo[a]xanthen-11-one (20). Yield (73%) as an orange solid; mp 179-182 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 8.03-7.85 (1H, d, J = 7.8 Hz, Ar-H), 7.83-7.65 (2H, m, Ar-H), 7.50-7.15 (5H, m, Ar-H), 7.04 (2H, d, J = 8.4 Hz, Ar-H), 5.69 (1H, s, CH), 2.81-2.53 (2H, m, CH₂), 2.50-2.20 (5H, m, CH₃, CH₂), 2.10-1.80 (2H, m, CH₂). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.3 (C=O), 165.8 (C), 147.9 (C), 142.3 (C), 136.1 (C), 131.7 (C), 131.5 (C), 129.5 (2xCH), 129.1 (CH), 128.6 (CH), 127.2 (CH), 126.8 (2xCH), 125.1 (CH), 123.8 (CH), 117.6 (C), 117.1 (CH), 115.5 (C), 37.2 (CH₂), 34.3 (CH), 27.9 (CH₂), 20.5 (CH₂), 16.0 (CH₃); IR (KBr) (ν_{max} /cm⁻¹): 3068, 3022, 2950, 2918, 2884, 1654, 1618, 1596, 1560, 1492, 1374, 1230, 1190, 1140, 1092, 1000, 956, 824, 750, 610; HRMS (ESI) m/z calcd for $C_{24}H_{20}SO_2$ (M+H)⁺ 373.1257, found 373.1310.

12-(2-Hydroxyphenyl)-8,9,10,12-tetrahydro-11H-benzo[a]xanthen-11-one (21). Yield (83%) as a white solid; mp 205-206 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 9.44 (s, 1H, OH), 7.88-7.77 (m, 2H, Ar-H), 7.71-7.60 (m, 1H, Ar-H), 7.48-7.31 (m, 3H, Ar-H), 7.10-6.88 (m, 2H, Ar-H), 6.70-6.42 (m, 2H, Ar-H), 5.78 (s, 1H, CH), 2.88-2.66 (m, 2H, CH₂), 2.62-2.38 (m, 2H, CH₂),

2.20-1.90 (m, 2H, CH₂). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 201.3 (C=O), 168.9 (C), 153.3 (C), 148.1 (C), 133.0 (C), 131.8 (C), 131.3 (C), 129.4 (CH), 129.2 (CH), 128.5 (CH), 128.2 (CH), 127.8 (CH), 125.5 (CH), 123.7 (CH), 121.7 (CH), 119.0 (CH), 117.8 (C), 116.8 (CH), 115.4 (C), 36.6 (CH₂), 28.4 (CH), 28.2 (CH₂), 20.2 (CH₂); IR (KBr) (ν_{max}/cm⁻¹): 3230, 3072, 3058, 3040, 2944, 2892, 1630, 1594, 1516, 1484, 1456, 1378, 1232, 1192, 1128, 1066, 1004, 958, 822, 764, 698, 650, 610, 480; Anal. calcd. for C₂₅H₂₂O₃: C, 80.68; H, 5.30. Found: C, 80.78; H, 5.15.

12-Phenyl-8,9,10,12-tetrahydro-11H-benzo[a]xanthen-11-one (22). Yield (73%) as a white solid; mp 182-184 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.83 (d, 1H, *J* = 7.7 Hz, Ar-H), 7.75-7.50 (m, 2H, Ar-H), 7.43-7.12 (m, 5H, Ar-H), 7.10-6.80 (m, 3H, Ar-H), 5.62 (s, 1H, CH), 2.70-2.40 (m, 2H, CH₂), 2.38-2.05 (m, 2H, CH₂), 2.00-1.52 (m, 2H, CH₂). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.1 (C=O), 165.7 (C), 147.8 (C), 145.2 (C), 131.6 (C), 131.5 (C), 128.9 (CH), 128.6 (2xCH), 128.4 (CH), 127.1 (2xCH), 126.4 (CH), 125.0 (CH), 124.7 (CH), 123.7 (CH), 117.8 (C), 117.1 (CH), 115.6 (C), 37.1 (CH₂), 34.7 (CH), 27.8 (CH₂), 20.3 (CH₂); IR (KBr) (ν_{max}/cm⁻¹): 3058, 3028, 2956, 2930, 2824, 1664, 1618, 1594, 1512, 1492, 1452, 1398, 1372, 1272, 1224, 1190, 1078, 1028, 1000, 954, 870, 832, 818, 702, 610, 530, 516; HRMS (ESI) *m/z* calcd for C₂₃H₁₈O₂ (M+H)⁺ 327.1380, found 327.1400.

10,10-Dimethyl-12-phenyl-9,10-dihydro-8H-benzo[a]xanthen-11(12H)-one (23). Yield (74%) as a white solid; mp 160-161 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 8.04 (d, 1H, *J* = 8.2 Hz, Ar-H), 7.88-7.66 (m, 2H, Ar-H), 7.54-7.31 (m, 5H, Ar-H), 7.29-6.95 (m, 3H, Ar-H), 5.78 (s, 1H, CH), 2.83-2.54 (m, 2H, CH₂), 2.08-1.71 (m, 2H, CH₂), 1.16 (s, 3H, CH₃), 1.07 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 202.0 (C=O), 163.6 (C), 147.8 (C), 145.2 (C), 131.6 (2xC), 128.9 (CH), 128.6 (2xCH), 128.5 (CH), 128.4 (2xCH), 127.1 (CH), 126.3 (CH), 124.9 (CH), 123.7 (CH), 117.8 (C), 117.1 (CH), 113.7 (C), 40.5 (C), 35.2 (CH), 33.9 (CH₂), 24.8 (CH₂), 24.4 (2xCH₃); IR (KBr) (ν_{max}/cm⁻¹): 3076, 3022, 2974, 2960, 2928, 2866, 1644, 1618, 1596, 1518, 1452, 1376, 1326, 1238, 1200, 1076, 948, 908, 834, 820, 750, 702, 624, 506; HRMS (ESI) *m/z* calcd for C₂₅H₂₂O₂ (M+H)⁺ 355.1693, found 355.1613.

10,10-Dimethyl-12-(4-fluorophenyl)-9,10-dihydro-8H-benzo[a]xanthen-11(12H)-one (24). Yield (78%) as a white solid; mp 157-159 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.96 (d, 1H, *J* = 8.1 Hz, Ar-H), 7.88-7.64 (m, 2H, Ar-H), 7.53-7.18 (m, 5H, Ar-H), 6.89 (t, 2H, *J* = 8.7 Hz, Ar-H), 5.75 (s, 1H, CH), 2.73 (t, 2H, *J* = 6.2 Hz, CH₂), 1.98-1.70 (m, 2H, CH₂), 1.16 (s, 3H, CH₃), 1.07 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 202.1 (C=O), 163.7 (C), 161.3 (d, *J*_{C-F} = 242.1 Hz, C), 147.8 (C), 141.1 (d, *J*_{C-F} = 2.7 Hz, C), 131.6 (C), 131.4 (C), 130.1 (d, *J*_{C-F} = 8.1 Hz, 2xCH), 129.1 (CH), 128.6 (CH), 127.2 (CH), 125.1 (CH), 123.7 (CH), 117.5 (C), 117.2 (CH), 115.2 (d, *J*_{C-F} = 21.3 Hz, 2xCH), 113.5 (C), 40.6 (C), 34.6 (CH), 33.9 (CH₂), 24.8 (CH₂), 24.4 (2xCH₃); IR (KBr) (ν_{max}/cm⁻¹): 3054, 2962, 2928, 2866, 1648, 1598, 1504, 1466,

1372, 1236, 1156, 1014, 958, 908, 810, 746, 620, 530, 500; HRMS (ESI) m/z calcd for $C_{25}H_{21}FO_2$ (M+H)⁺ 373.1598, found 373.1611.

10,10-Dimethyl-12-(4-(methylthio)phenyl)-9,10-dihydro-8H-benzo[a]xanthen-11(12H)-one (25). Yield (90%) as a white solid; mp 159-160 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 8.08 (d, 1H, *J* = 8.0 Hz, Ar-H), 7.85-7.62 (m, 2H, Ar-H), 7.53-7.19 (m, 5H, Ar-H), 7.08 (d, 2H, *J* = 8.2 Hz, Ar-H), 5.70 (s, 1H, CH), 2.72 (t, 2H, *J* = 6.2 Hz, CH₂), 2.36 (s, 3H, CH₃), 2.01-1.72 (m, 2H, CH₂), 1.14 (s, 3H, CH₃), 1.07 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 202.0 (C=O), 163.6 (C), 147.8 (C), 142.3 (C), 135.9 (C), 131.6 (C), 131.4 (C), 129.0 (2xCH), 128.9 (CH), 128.5 (CH), 127.1 (CH), 126.6 (2xCH), 125.0 (CH), 123.7 (CH), 117.5 (C), 117.1 (CH), 113.5 (C), 40.5 (C), 34.7 (CH), 33.9 (CH₂), 24.9 (CH₃), 24.8 (CH₂), 24.4 (CH₃), 15.8 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3068, 3020, 2958, 2916, 2866, 1646, 1596, 1490, 1372, 1234, 1196, 1090, 956, 844, 818, 748, 730, 512; HRMS (ESI) m/z calcd for $C_{26}H_{24}SO_2$ (M+H)⁺ 401.1570, found 401.1555.

10,10-Dimethyl-12-(3-methoxyphenyl)-9,10-dihydro-8H-benzo[a]xanthen-11(12H)-one (26). Yield (82%) as a white solid; mp 161-162 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.99 (d, 1H, *J* = 7.8 Hz, Ar-H), 7.88-7.61 (m, 2H, Ar-H), 7.54-7.21 (m, 3H, Ar-H), 7.16-6.77 (m, 3H, Ar-H), 6.59 (d, 1H, *J* = 7.8 Hz, Ar-H), 5.69 (s, 1H, CH), 3.68 (s, 3H, CH₃), 2.69 (t, 2H, *J* = 5.8 Hz, CH₂), 2.04-1.73 (m, 2H, CH₂), 1.11 (s, 3H, CH₃), 1.04 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 201.8 (C=O), 163.6 (C), 159.5 (C), 147.8 (C), 146.7 (C), 131.5 (C), 129.1 (CH), 128.8 (CH), 128.4 (CH), 127.0 (CH), 124.9 (CH), 123.6 (2xCH), 121.1 (CH), 117.6 (C), 117.0 (C), 114.9 (CH), 113.5 (C), 111.0 (CH), 55.0 (CH₃), 40.5 (C), 35.0 (CH), 33.7 (CH₂), 24.8 (CH₃), 24.7 (CH₂), 24.3 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3048, 2994, 2962, 2928, 2832, 1648, 1598, 1584, 1518, 1488, 1452, 1374, 1314, 1260, 1200, 1144, 1052, 956, 818, 774, 748, 718, 694, 526; HRMS (ESI) m/z calcd for $C_{26}H_{24}O_3$ (M+H)⁺ 385.1798, found 385.1732.

10,10-Dimethyl-12-(4-methoxyphenyl)-9,10-dihydro-8H-benzo[a]xanthen-11(12H)-one (27). Yield (84%) as a white solid; mp 159-162 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.97 (d, 1H, *J* = 7.7 Hz, Ar-H), 7.83-7.64 (m, 2H, Ar-H), 7.55-7.11 (m, 5H, Ar-H), 6.69 (d, 2H, *J* = 7.3 Hz, Ar-H), 5.65 (s, 1H, CH), 2.68 (s, 3H, CH₃), 2.70 (t, 2H, *J* = 5.7 Hz, CH₂), 2.00-1.69 (m, 2H, CH₂), 1.11 (s, 3H, CH₃), 1.04 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 202.1 (C=O), 163.4 (C), 157.9 (C), 147.8 (C), 137.6 (C), 131.6 (C), 131.5 (C), 129.5 (2xCH), 128.8 (CH), 128.5 (CH), 127.0 (CH), 124.9 (CH), 123.8 (CH), 118.0 (C), 117.1 (CH), 113.8 (C), 113.7 (2xCH), 55.2 (CH₃), 40.6 (C), 34.4 (CH), 33.9 (CH₂), 24.9 (CH₃), 24.8 (CH₂), 24.4 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3026, 3010, 2956, 2926, 2830, 1648, 1598, 1508, 1458, 1374, 1254, 1200, 1104, 1034, 954, 830, 810, 746, 550; HRMS (ESI) m/z calcd for $C_{26}H_{24}O_3$ (M+H)⁺ 385.1798, found 385.1722.

10,10-Dimethyl-12-(naphthalen-1-yl)-9,10-dihydro-8H-benzo[a]xanthen-11(12H)-one (28). Yield (88%) as a brown solid; mp 200-202 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 9.19 (d, 1H, *J* = 8.5 Hz, Ar-H), 7.91 (d, 1H, *J* = 7.8 Hz, Ar-H), 7.84-7.65 (m, 4H, Ar-H), 7.60-7.06 (m, 7H, Ar-H), 6.41 (s, 1H, CH), 2.78 (s, 2H, CH₂), 1.84 (t, 2H, *J* = 5.7 Hz, CH₂), 1.10 (s, 3H, CH₃), 0.91 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 202.1 (C=O), 163.5(C), 147.6 (C), 143.2 (C), 133.6 (C), 131.8 (C), 131.4 (C), 131.1 (C), 128.7 (2xCH), 128.4 (CH), 127.9 (2xCH), 127.2 (CH), 127.1 (CH), 126.4 (CH), 125.5 (CH), 124.8 (2xCH), 123.8 (CH), 119.8 (C), 117.2 (CH), 114.6 (C), 40.5 (C), 33.8 (CH₂), 30.8 (CH), 25.0 (CH₂), 24.7 (CH₃), 24.4 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3048, 2962, 2930, 2864, 1714, 1646, 1618, 1592, 1510, 1460, 1370, 1326, 1196, 1100, 1070, 1028, 944, 906, 820, 782, 736, 484; HRMS (ESI) *m/z* calcd for C₂₉H₂₄O₂ (M+H)⁺ 405.1849, found 405.1908.

10,10-Dimethyl-12-(4-hydroxy-3,5-dimethoxyphenyl)-9,10-dihydro-8H-benzo[a]xanthen-11(12H)-one (29). Yield (59%) as a white solid; mp 212-214 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 8.10-7.92 (bs, 1H, Ar-H), 7.85-7.68 (bs, 2H, Ar-H), 7.58-7.22 (m, 3H, Ar-H), 6.54 (s, 2H, Ar-H), 5.68 (bs, 1H, CH), 5.40 (bs, 1H, OH), 3.74 (s, 6H, 2xCH₃), 2.92-2.52 (m, 2H, CH₂), 2.06-1.69 (m, 2H, CH₂), 1.12 (s, 3H, CH₃), 1.08 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 202.3(C=O), 163.6 (C), 148.0 (C), 146.9 (2xC), 136.6 (C), 133.2(C), 131.6 (C), 131.5 (C), 128.9 (CH), 128.5 (CH), 127.1 (CH), 125.0 (CH), 123.8 (CH), 117.7 (C), 117.0 (CH), 113.8 (C), 105.4 (2xCH), 56.4 (2xCH₃), 40.7 (C), 34.9 (CH), 33.9 (CH₂), 25.0 (CH₃), 24.9 (CH₂), 24.5 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3550, 3370, 3070, 2954, 2932, 2836, 1644, 1618, 1598, 1518, 1464, 1426, 1372, 1326, 1220, 1122, 950, 918, 820, 748, 718, 644, 540; HRMS (ESI) *m/z* calcd for C₂₆H₂₄O₃ (M+H)⁺ 431.1853, found 431.1850.

10,10-Dimethyl-12-(naphthalen-2-yl)-9,10-dihydro-8H-benzo[a]xanthen-11(12H)-one (30). Yield (82%) as a yellow solid; mp 217-218 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 8.02 (d, 2H, *J* = 8.1 Hz, ArH), 7.86-7.60 (m, 6H, Ar-H), 7.56-7.43 (m, 1H, Ar-H), 7.41-7.19 (m, 5H, Ar-H), 5.88 (s, 1H, CH), 2.68 (t, 2H, *J* = 6.1 Hz, CH₂), 1.87-1.63 (m, 2H, CH₂), 1.08 (s, 3H, CH₃), 0.96 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 202.1 (C=O), 163.8 (C), 148.0 (C), 142.7 (C), 133.5 (C), 132.3 (C), 131.6 (C), 129.1 (CH), 128.5 (CH), 128.2 (2xCH), 127.6 (CH), 127.3 (CH), 127.2 (CH), 127.1 (CH), 125.9 (CH), 125.5 (CH), 125.0 (CH), 123.8 (CH), 117.8 (C), 117.2 (CH), 113.6 (C), 40.6 (C), 35.5 (CH), 33.9 (CH₂), 24.9 (CH₂, CH₃), 24.4 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3056, 3022, 2964, 2936, 2860, 1654, 1620, 1596, 1508, 1460, 1450, 1370, 1328, 1236, 1196, 1102, 1072, 1028, 948, 854, 822, 784, 748, 548, 474; HRMS (ESI) *m/z* calcd for C₂₉H₂₄O₂ (M+H)⁺ 405.1849, found 405.1811.

10,10-Dimethyl-12-(benzo[d][1,3]dioxol-5-yl)-8,9,10,12-tetrahydro-11H-benzo[a]xanthen-11-one (31). Yield (79%) as a white solid; mp 202-204 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.99 (1H, d, *J* = 8.1 Hz, Ar-H), 7.88-7.67 (m, 2H, Ar-H), 7.58-7.18 (m, 3H, Ar-H), 6.88 (d, 1H, *J* = 8.0 Hz, Ar-H), 6.77 (s, 1H, Ar-H), 6.63 (d, 1H, *J* = 8.0 Hz, Ar-H), 5.95-5.71 (d, 2H, *J*

= 8.7 Hz, OCH₂O), 5.65 (s, 1H, CH), 2.90-2.60 (m, 2H, CH₂), 2.04-1.72 (m, 2H, CH₂), 1.14 (s, 3H, CH₃), 1.08 (s, 3H, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 202.2 (C=O), 163.7 (C), 147.9 (C), 147.6 (C), 145.9 (C), 139.4 (C), 131.7 (C), 131.6 (C), 129.0 (CH), 128.6 (CH), 127.2 (CH), 125.1 (CH), 123.8 (CH), 122.0 (CH), 117.9 (C), 117.2 (CH), 113.8 (C), 109.2 (CH), 108.1 (CH), 100.9 (CH₂), 40.7 (C), 34.9 (CH), 34.0 (CH₂), 25.0 (CH₃), 24.9 (CH₂), 24.5 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3060, 2980, 2954, 2934, 2856, 2854, 2772, 1714, 1650, 1596, 1500, 1484, 1374, 1236, 1200, 1038, 954, 924, 814, 744, 528; HRMS (ESI) *m/z* calcd for C₂₆H₂₂O₄ (M+H)⁺ 399.1591, found 399.1613.

10,10-Dimethyl-12-(4-chlorophenyl)-8,9,10,12-tetrahydro-11H-benzo[a]xanthen-11-one

(32). Yield (81%) as a white solid; mp 168-170 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.94 (d, 1H, *J* = 8.1 Hz, Ar-H), 7.85-7.63 (m, 2H, Ar-H), 7.55-7.24 (m, 5H, Ar-H), 7.16 (d, 2H, *J* = 8.5 Hz, Ar-H), 5.73 (s, 1H, CH), 2.86-2.58 (m, 2H, CH₂), 2.02-1.66 (m, 2H, CH₂), 1.15 (s, 3H, CH₃), 1.07 (s, 3H, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 202.0 (C=O), 163.8 (C), 147.8 (C), 143.8 (C), 132.0 (C), 131.6 (C), 131.4 (C), 130.0 (2xCH, C), 129.2 (CH), 128.6 (CH), 128.5 (2xCH), 127.2 (CH), 125.1 (CH), 123.6 (CH), 117.2 (CH), 113.3 (C), 40.6 (C), 34.8 (CH₃, CH), 33.9 (CH₂), 24.8 (CH₂), 24.4 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3078, 3046, 2958, 2926, 2856, 1642, 1598, 1488, 1376, 1330, 1238, 1200, 1090, 1016, 954, 840, 742, 510; HRMS (ESI) *m/z* calcd for C₂₅H₂₁ClO₂ (M+H)⁺ 389.1303, found 389.1349.

7,7-Dimethyl-10-(4-(methylthio)phenyl)-6,7,8,10-tetrahydro-9H-[1,3]-dioxolo[4,5-

b]xanthen-9-one (33). Yield (81%) as an orange solid; mp 177-179 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.14 (bs, 4H, Ar-H), 6.59 (s, 1H, Ar-H), 6.46 (s, 1H, Ar-H), 5.89 (bs, 1H, OCH₂O), 5.85 (bs, 1H, OCH₂O), 4.86 (s, 1H, CH), 2.51 (s, 2H, CH₂), 2.41 (s, 3H, CH₃), 2.33-2.08 (m, 2H, CH₂), 1.11 (s, 3H, CH₃), 1.02 (s, 3H, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 196.9 (C=O), 164.5 (C), 146.9 (C), 144.9 (C), 143.9 (C), 143.4 (C), 136.2 (C), 128.4 (2xCH), 126.9 (2xCH), 117.4 (C), 112.7 (C), 108.3 (CH), 101.6 (CH₂), 98.3 (CH), 50.9 (CH₂), 41.5 (CH₂), 37.8 (CH), 32.2 (C), 29.5 (CH₃), 27.5 (CH₃), 16.0 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3038, 2960, 2912, 1650, 1618, 1504, 1480, 1376, 1218, 1144, 1092, 1030, 932, 840, 760. Anal. calcd. for C₂₃H₂₂SO₄: C, 70.03; H, 5.62. Found: C, 69.99; H, 5.75.

7,7-Dimethyl-10-(naphthalen-1-yl)-6,7,8,10-tetrahydro-9H-[1,3]-dioxolo[4,5-b]xanthen-9-

one (34). Yield (77%) as a white solid; mp 206-208 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 8.56 (bs, 1H, ArH), 7.84 (d, 1H, *J* = 8.0 Hz, ArH), 7.77-7.25 (m, 5H, ArH), 6.61 (s, 1H, ArH), 6.46 (s, 1H, ArH), 6.02-5.64 (m, 3H, CH₂, CH), 2.60 (s, 2H, CH₂), 2.34-2.07 (m, 2H, CH₂), 1.15 (s, 3H, CH₃), 1.06 (s, 3H, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.0 (C=O), 164.6 (C), 146.9 (C), 144.7 (C), 143.4 (2xC), 134.1 (C), 131.2 (C), 128.9 (CH), 127.3 (CH), 126.4 (CH), 125.6 (3xCH), 123.7 (CH), 118.4 (C), 113.2 (C), 107.8 (CH), 101.5 (CH₂), 98.4 (CH), 50.8 (CH₂), 41.6 (CH₂), 32.2 (C), 29.4 (CH₃, CH), 27.6 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3050, 2996,

2948, 2878, 2770, 1654, 1618, 1500, 1478, 1374, 1332, 1288, 1186, 1166, 1146, 1030, 936, 864, 790, 774, 478; HRMS (ESI) m/z calcd for $C_{26}H_{22}O_4$ (M+H)⁺ 399.1591, found 399.1645.

7,7-Dimethyl-10-(4-fluorophenyl)-6,7,8,10-tetrahydro-9H-[1,3]-dioxolo[4,5-*b*]xanthen-9-one (35). Yield (75%) as a white solid; mp 192-194 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.25-7.07 (m, 2H, ArH), 7.00-6.80 (m, 2H, ArH), 6.59 (s, 1H, ArH), 6.45 (s, 1H, ArH), 5.91 (d, 1H, J = 1.3 Hz, OCH₂O), 5.86 (d, 1H, J = 1.3 Hz, OCH₂O), 4.89 (s, 1H, CH), 2.51 (s, 2H, CH₂), 2.42-2.06 (m, 2H, CH₂), 1.11 (s, 3H, CH₃), 1.00 (s, 3H, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.0 (C=O), 164.5 (C), 161.5 (d, J_{C-F} = 244.6 Hz, C), 147.1 (C), 144.9 (C), 144.0 (C), 142.1 (d, J_{C-F} = 2.7 Hz, C), 129.4 (d, J_{C-F} = 7.9 Hz, 2xCH), 117.3 (C), 115.3 (d, J_{C-F} = 21.3 Hz, 2xCH), 112.8 (C), 108.3 (CH), 101.7 (CH₂), 98.4 (CH), 50.9 (CH₂), 41.6 (CH₂), 37.6 (CH), 32.3 (C), 29.5 (CH₃), 27.4 (CH₃); IR (KBr) (ν_{max}/cm^{-1}): 3072, 2962, 2954, 2890, 2774, 1650, 1620, 1602, 1504, 1480, 1438, 1372, 1334, 1296, 1192, 1166, 1146, 1096, 1030, 934, 870, 854, 788, 760, 690, 602, 536; HRMS (ESI) m/z calcd for $C_{22}H_{19}FO_4$ (M+H)⁺ 367.1340, found 367.1370.

7,7-Dimethyl-10-(2-hydroxyphenyl)-6,7,8,10-tetrahydro-9H-[1,3]-dioxolo[4,5-*b*]xanthen-9-one (36). Yield (92%) as a white solid; mp 219-222 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 9.10 (s, 1H, OH), 7.14-6.93 (m, 2H, Ar-H), 6.84-6.69 (m, 1H, Ar-H), 6.68-6.52 (m, 2H, Ar-H), 6.40 (s, 1H, Ar-H), 5.95-5.86 (m, 2H, OCH₂O), 5.14 (s, 1H, CH), 2.52 (s, 2H, CH₂), 2.43-2.18 (m, 2H, CH₂), 1.13 (s, 3H, CH₃), 0.95 (s, 3H, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 200.7 (C=O), 167.3 (C), 153.6 (C), 147.3 (C), 145.5 (C), 145.0 (C), 133.4 (C), 129.7 (CH), 128.0 (CH), 121.4 (CH), 118.8 (CH), 117.1 (C), 113.4 (C), 108.7 (CH), 101.8 (CH₂), 98.1 (CH), 50.4 (CH₂), 41.8 (CH₂), 32.4 (C), 31.0 (CH), 29.2 (CH₃), 27.3 (CH₃); IR (KBr) (ν_{max}/cm^{-1}): 3380, 3064, 3028, 2964, 2954, 2928, 1638, 1614, 1482, 1446, 1382, 1276, 1230, 1144, 1032, 934, 858, 760, 750. Anal. calcd. for $C_{22}H_{20}O_5$: C, 72.51; H, 5.53. Found: C, 72.85; H, 5.05.

7,7-Dimethyl-10-(benzo[*d*][1,3]dioxol-5-yl)-6,7,8,10-tetrahydro-9H-[1,3]-dioxolo[4,5-*b*]xanthen-9-one (37). Yield (71%) as a white solid; mp 185-187 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 6.82-6.61 (m, 3H, Ar-H), 6.57 (s, 1H, Ar-H), 6.47 (s, 1H, Ar-H), 5.93-5.60 (m, 4H, 2xOCH₂O), 4.81 (s, 1H, CH), 2.49 (s, 2H, CH₂), 2.35-2.07 (m, 2H, CH₂), 1.10 (s, 3H, CH₃), 1.03 (s, 3H, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 196.8 (C=O), 164.3 (C), 147.7 (C), 146.8 (C), 146.0 (C), 144.8 (C), 143.7 (C), 140.4 (C), 120.9 (CH), 117.5 (C), 112.6 (C), 108.2 (CH), 108.1 (2xCH), 101.5 (CH₂), 100.9 (CH₂), 98.2 (CH), 50.8 (CH₂), 41.4 (CH₂), 37.8 (CH), 32.1 (C), 29.3 (CH₃), 27.4 (CH₃); IR (KBr) (ν_{max}/cm^{-1}): 3054, 3004, 2966, 2914, 1714, 1652, 1618, 1500, 1484, 1438, 1372, 1244, 1186, 1146, 1038, 932, 792, 634; HRMS (ESI) m/z calcd for $C_{23}H_{20}O_6$ (M+H)⁺ 393.1333, found 393.1308.

7,7-Dimethyl-10-phenyl-6,7,8,10-tetrahydro-9H-[1,3]-dioxolo[4,5-*b*]xanthen-9-one (38). Yield (71%) as a white solid; mp 183-185 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.22-6.90 (m, 5H, ArH), 6.49 (s, 1H, ArH), 6.39 (s, 1H, ArH), 5.79 (bs, 1H, OCH₂O), 5.74 (bs, 1H,

OCH₂O), 4.81 (s, 1H, CH), 2.42 (s, 2H, CH₂), 2.24-2.00 (m, 2H, CH₂), 1.02 (s, 3H, CH₃), 0.92 (s, 3H, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 196.9 (C=O), 164.5 (C), 147.0 (C), 146.3 (C), 144.9 (C), 144.0 (C), 128.6 (2xCH), 127.9 (2xCH), 126.6 (CH), 117.7 (C), 112.9 (C), 108.5 (CH), 101.6 (CH₂), 98.3 (CH), 51.0 (CH₂), 41.6 (CH₂), 38.4 (CH), 32.3 (C), 29.5 (CH₃), 27.5 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3062, 3032, 2966, 2892, 1652, 1620, 1502, 1480, 1374, 1224, 1210, 1146, 1030, 934, 872, 746, 700, 526; HRMS (ESI) *m/z* calcd for C₂₂H₂₀O₄ (M+H)⁺ 349.1434, found 349.1479.

10-(3-Methoxyphenyl)-7,7-dimethyl-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (39). Yield (79%) as a yellow solid; mp 137-138 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.15 (t, 1H, *J* = 7.8 Hz, ArH), 6.87-6.76 (m, 2H, ArH), 6.72-6.63 (s, 1H, ArH), 6.58 (s, 1H, ArH), 6.51 (s, 1H, ArH), 5.89 (d, 1H, *J* = 1.3 Hz, OCH₂O), 5.83 (d, 1H, *J* = 1.3 Hz, OCH₂O), 4.88 (s, 1H, CH), 3.74 (s, 3H, CH₃), 2.52 (s, 2H, CH₂), 2.25 (bs, 2H, CH₂), 1.12 (s, 3H, CH₃), 1.05 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 196.9 (C=O), 164.5 (C), 159.7 (C), 147.9 (C), 146.9 (C), 144.8 (C), 143.9 (C), 129.5 (CH), 120.3 (CH), 117.5 (CH), 113.9 (CH), 112.6 (C), 111.6 (CH), 108.3 (CH), 101.6 (CH₂), 98.3 (CH), 55.2 (CH₃), 50.9 (CH₂), 41.5 (CH₂), 38.3 (CH), 32.2 (C), 29.4 (CH₃), 27.5 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3068, 3048, 2958, 2896, 1652, 1618, 1502, 1482, 1438, 1376, 1314, 1210, 1148, 1030, 930, 880, 760, 696, 560; HRMS (ESI) *m/z* calcd for C₂₃H₂₂O₅ (M+H)⁺ 379.1540, found 379.1499.

7,7-Dimethyl-10-(4-hydroxy-3,5-dimethoxyphenyl)-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (40). Yield (62%) as a yellow solid; mp 188-190 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 6.59 (s, 1H, ArH), 6.50 (s, 1H, ArH), 6.43 (s, 2H, ArH), 6.01-5.74 (m, 2H, OCH₂O), 5.50 (s, 1H, OH), 4.79 (s, 1H, CH), 3.79 (s, 6H, 2xCH₃), 2.50 (bs, 2H, CH₂), 2.23 (bs, 2H, CH₂), 1.10 (s, 3H, CH₃), 1.04 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.0 (C=O), 164.5 (C), 147.1 (2xC), 146.9 (C), 144.8 (C), 143.8 (C), 137.6 (C), 133.5 (C), 117.7 (C), 112.8 (C), 108.2 (CH), 104.6 (2xCH), 101.6 (CH₂), 98.2 (CH), 56.2 (2xCH₃), 50.8 (CH₂), 41.5 (CH₂), 38.3 (CH), 32.6 (C), 29.6 (CH₃), 27.1 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3466, 3012, 2952, 2934, 1652, 1618, 1518, 1480, 1466, 1432, 1374, 1328, 1208, 1188, 1110, 1032, 936, 788, 762, 670, 560; HRMS (ESI) *m/z* calcd for C₂₄H₂₄O₇ (M+H)⁺ 425.1595, found 425.1581.

7,7-Dimethyl-10-(3-hydroxyphenyl)-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (41). Yield (65%) as a yellow solid; mp 137-138 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.18-6.99 (m, 1H, ArH), 6.97-6.82 (m, 1H, ArH), 6.76-6.38 (m, 5H, ArH, OH), 5.92 (d, 1H, *J* = 1.3 Hz, OCH₂O), 5.87 (d, 1H, *J* = 1.3 Hz, OCH₂O), 4.88 (s, 1H, CH), 2.52 (s, 2H, CH₂), 2.12-2.38 (m, 2H, CH₂), 1.12 (s, 3H, CH₃), 1.03 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 198.2 (C=O), 165.3 (C), 156.3 (C), 147.8 (C), 147.0 (C), 145.0 (C), 144.0 (C), 129.9 (CH), 119.9 (CH), 117.5 (C), 115.4 (CH), 113.8 (CH), 112.9 (C), 108.5 (CH), 101.7 (CH₂), 98.3 (CH), 50.9 (CH₂), 41.7 (CH₂), 38.3 (CH), 32.5 (C), 29.5 (CH₃), 27.7 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3318,

2952, 2928, 2892, 1638, 1600, 1504, 1484, 1450, 1380, 1210, 1156, 1032, 930, 864, 758, 694, 620, 562; HRMS (ESI) m/z calcd for $C_{22}H_{20}O_5$ (M+H)⁺ 364.1311, found 364.1297.

7,7-Dimethyl-10-(4-chlorophenyl)-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (42). Yield (85%) as a yellow solid; mp 190-192 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.17 (bs, 4H, Ar-H), 6.59 (s, 1H, ArH), 6.43 (s, 1H, ArH), 5.88 (bs, 1H, OCH₂O), 5.84 (bs, 1H, OCH₂O), 4.88 (s, 1H, CH), 2.50 (s, 2H, CH₂), 2.33-2.04 (m, 2H, CH₂), 1.10 (s, 3H, CH₃), 1.00 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 196.7 (C=O), 164.5 (C), 147.0 (C), 144.9 (C), 144.7 (C), 143.9 (C), 132.1 (C), 129.3 (2xCH), 128.6 (2xCH), 116.8 (C), 112.4 (C), 108.2 (CH), 101.6 (CH₂), 98.3 (CH), 50.8 (CH₂), 41.4 (CH₂), 37.7 (CH), 32.2 (C), 29.4 (CH₃), 27.3 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3044, 2956, 2930, 2884, 1714, 1650, 1618, 1508, 1484, 1442, 1376, 1214, 1168, 1090, 1032, 930, 844, 760, 564, 528; HRMS (ESI) m/z calcd for $C_{22}H_{19}ClO_4$ (M+H)⁺ 383.1045, found 383.1008.

7,7-Dimethyl-10-(naphthalen-2-yl)-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (43). Yield (77%) as a yellow solid; mp 179-181 °C; ¹H (200 MHz, CDCl₃): δ_H (ppm) 7.94-7.66 (m, 4H, ArH), 7.58-7.29 (m, 3H, ArH), 6.67 (s, 1H, ArH), 6.56 (s, 1H, ArH), 5.91 (d, 1H, *J* = 0.9 Hz, OCH₂O), 5.84 (d, 1H, *J* = 0.9 Hz, OCH₂O), 5.13 (s, 1H, CH), 2.56 (s, 2H, CH₂), 2.26 (m, 2H, CH₂), 1.13 (s, 3H, CH₃), 1.04 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 196.9 (C=O), 164.6 (C), 147.0 (C), 144.9 (C), 144.0 (C), 143.5 (C), 133.6 (C), 132.4 (C), 128.5 (CH), 128.1 (CH), 127.7 (CH), 126.4 (CH), 126.2 (CH), 126.1 (CH), 125.6 (CH), 117.5 (C), 112.6 (C), 108.6 (CH), 101.6 (CH₂), 98.4 (CH), 50.9 (CH₂), 41.6 (CH₂), 38.6 (CH), 32.3 (C), 29.5 (CH₃), 27.5 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3050, 2958, 2980, 2772, 1652, 1618, 1560, 1504, 1480, 1376, 1224, 1186, 1146, 1030, 932, 888, 862, 796, 746, 670, 562; HRMS (ESI) m/z calcd for $C_{26}H_{22}O_4$ (M+H)⁺ 399.1591, found 399.1548.

7,7-Dimethyl-10-(4-hydroxy-3-methoxyphenyl)-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (44). Yield (59%) as a yellow solid; mp 176-178 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 6.80-6.76 (m, 2H, ArH), 6.63-6.54 (m, 2H, ArH), 6.50 (s, 1H, ArH), 5.93-5.84 (m, 3H, OCH₂O, OH), 4.82 (s, 1H, CH), 3.79 (s, 3H, CH₃), 2.50 (s, 2H, CH₂), 2.38-2.03 (m, 2H, CH₂), 1.10 (s, 3H, CH₃), 1.03 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.2 (C=O), 164.5 (C), 146.8 (C), 146.5 (C), 144.8 (C), 144.3 (C), 143.8 (C), 138.4 (C), 120.4 (CH), 117.8 (CH), 114.6 (CH), 113.0 (C), 110.8 (CH), 108.3 (CH), 101.5 (CH₂), 98.2 (CH), 55.9 (CH₃), 50.8 (CH₂), 41.5 (CH₂), 37.8 (CH), 32.2 (C), 29.5 (CH₃), 27.3 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3368, 3014, 2956, 2932, 1652, 1618, 1514, 1484, 1376, 1276, 1226, 1030, 920, 862, 752, 670, 632, 560; HRMS (ESI) m/z calcd for $C_{23}H_{22}O_6$ (M+H)⁺ 394.1416, found 394.1428.

10-(Naphthalen-1-yl)-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (45). Yield (75%) as a white solid; mp 201-202 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 8.67 (d, 1H, *J* = 8.5 Hz, ArH), 7.87 (d, 1H, *J* = 8.0 Hz, ArH), 7.77-7.61 (m, 2H, ArH), 7.58-7.22 (m, 3H, ArH),

6.68 (s, 1H, ArH), 6.54 (s, 1H, ArH), 5.94-5.80 (s, 2H, OCH₂O), 5.73 (s, 1H, CH), 2.88-2.56 (s, 2H, CH₂), 2.46-2.27 (m, 2H, CH₂), 2.12-1.91 (m, 2H, CH₂). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.0 (C=O), 166.2 (C), 146.8 (C), 144.6 (C), 143.3 (2xC), 134.0 (C), 131.1 (C), 128.8 (CH), 127.2 (CH), 126.6 (CH), 126.4 (CH), 125.7 (CH), 125.5 (CH), 123.7 (CH), 118.3 (C), 114.4 (C), 107.6 (CH), 101.5 (CH₂), 98.2 (CH), 37.0 (CH₂), 33.3 (CH), 27.9 (CH₂), 20.5 (CH₂). IR (KBr) (ν_{max}/cm⁻¹): 3056, 2956, 2940, 2900, 2782, 1710, 1658, 1620, 1500, 1480, 1380, 1356, 1224, 1186, 1142, 1036, 1000, 936, 856, 788, 738, 674, 532, 454. HRMS (ESI) *m/z* calcd for C₂₄H₁₈O₄ (M+H)⁺ 371.1278, found 371.1242.

10-(4-(Methylthio)phenyl)-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (46). Yield (85%) as a white solid; mp 169-171 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.14 (bs, 4H, Ar-H), 6.59 (s, 1H, ArH), 6.46 (s, 1H, ArH), 5.97-5.82 (m, 2H, OCH₂O), 4.89 (s, 1H, CH), 2.73-2.54 (m, 2H, CH₂), 2.53-2.22 (m, 5H, CH₃, CH₂), 2.14-1.86 (m, 2H, CH₂); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.1 (C=O), 166.2 (C), 147.0 (C), 144.9 (C), 144.0 (C), 143.5 (C), 136.3 (C), 128.5 (2xCH), 127.0 (2xCH), 117.4 (C), 114.0 (C), 108.3 (CH), 101.6 (CH₂), 98.3 (CH), 37.7 (CH), 37.1 (CH₂), 27.9 (CH₂), 20.5 (CH₂), 16.1 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3052, 2946, 2880, 2772, 1712, 1648, 1616, 1500, 1486, 1436, 1380, 1244, 1230, 1182, 1038, 998, 938, 842, 784, 744, 594, 532, 512; HRMS (ESI) *m/z* calcd for C₂₁H₁₈SO₄ (M+H)⁺ 367.0999, found 367.1112.

10-(4-Chlorophenyl)-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (47). Yield (78%) as a yellow solid; mp 158-161 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.16-7.01 (m, 4H, Ar-H), 6.51 (s, 1H, ArH), 6.35 (s, 1H, ArH), 5.84 (m, 1H, OCH₂O), 5.80 (m, 1H, OCH₂O), 4.82 (s, 1H, CH), 2.78-2.43 (s, 2H, CH₂), 2.40-2.11 (m, 2H, CH₂), 2.11-1.69 (m, 2H, CH₂); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.2 (C=O), 166.4 (C), 147.2 (C), 145.1 (C), 144.9 (C), 144.1 (C), 132.3 (C), 129.5 (2xCH), 128.7 (2xCH), 117.1 (C), 113.9 (C), 108.3 (CH), 101.8 (CH₂), 98.4 (CH), 37.8 (CH), 37.2 (CH₂), 28.0 (CH₂), 20.6 (CH₂); IR (KBr) (ν_{max}/cm⁻¹): 3068, 3046, 2952, 2890, 2772, 1650, 1620, 1500, 1482, 1374, 1244, 1184, 1092, 1038, 998, 936, 844, 784, 744, 592, 530; HRMS (ESI) *m/z* calcd for C₂₀H₁₅ClO₄ (M+H)⁺ 355.0732, found 355.0712.

10-(4-Hydroxy-3-methoxyphenyl)-7,8-dihydro-6H [1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (48). Yield (58%) as a yellow solid; mp 176-178 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 6.97-6.30 (m, 5H, ArH), 6.08-5.78 (m, 2H, OCH₂O), 5.61 (1H, s, OH), 4.87 (1H, s, CH), 3.85 (s, 3H, CH₃), 2.89-2.56 (2H, s, CH₂), 2.52-2.22 (2H, m, CH₂), 2.20-1.89 (2H, m, CH₂); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.5 (C=O), 166.2 (C), 146.9 (C), 146.4 (C), 144.9 (C), 144.3 (C), 144.1 (C), 138.7 (C), 120.6 (CH), 117.9 (C), 114.6 (C, CH), 111.0 (CH), 108.4 (CH), 101.7 (CH₂), 98.3 (CH), 56.1 (CH₃), 37.8 (CH), 37.2 (CH₂), 28.0 (CH₂), 20.6 (CH₂); IR (KBr) (ν_{max}/cm⁻¹): 3402, 3054, 3248, 2988, 2964, 2932, 2900, 2836, 2778, 1648, 1618, 1598, 1502, 1484, 1432, 1376, 1278, 1226, 1186, 1146, 1036, 1000, 936, 892, 736, 532; HRMS (ESI) *m/z* calcd for C₂₁H₁₈O₆ (M+H)⁺ 367.1176, found 367.1187.

10-(4-Hydroxy-3,5-dimethoxyphenyl)-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (49). Yield (55%) as a yellow solid; mp 176-178 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 6.58 (s, 1H, ArH), 6.50 (s, 1H, ArH), 6.43 (s, 2H, ArH), 6.09-5.75 (m, 2H, OCH₂O), 5.52 (s, 1H, OH), 4.84 (s, 1H, CH), 3.80 (s, 6H, 2xCH₃), 2.73-2.49 (s, 2H, CH₂), 2.47-2.16 (m, 2H, CH₂), 2.14-1.86 (m, 2H, CH₂); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.4 (C=O), 166.2 (C), 147.0 (2xC), 146.9 (C), 144.9 (C), 144.0 (C), 137.7 (C), 133.5 (C), 117.6 (C), 114.2 (C), 108.2 (CH), 104.9 (2xCH), 101.6 (CH₂), 98.2 (CH), 56.4 (2xCH₃), 38.1 (CH), 37.1 (CH₂), 27.9 (CH₂), 20.5 (CH₂); IR (KBr) (ν_{max}/cm⁻¹): 3598, 3492, 2954, 2900, 2842, 1648, 1618, 1482, 1436, 1372, 1328, 1224, 1184, 1122, 1038, 1000, 938, 790, 730, 640, 532; HRMS (ESI) *m/z* calcd for C₂₂H₂₀O₇ (M+H)⁺ 397.1282, found 397.1216.

10-(Naphthalen-1-yl)-6,7,8,10-tetrahydro-9H-[1,3]-dioxolo[4,5-*b*]xanthen-9-one (50). Yield (78%) as a white solid; mp 167-169 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.90-7.67 (m, 4H, Ar-H), 7.57-7.31 (m, 3H, Ar-H), 6.68 (s, 1H, Ar-H), 6.57 (s, 1H, Ar-H), 5.92 (bs, 1H, OCH₂O), 5.85 (bs, 1H, OCH₂O), 5.16 (s, 1H, CH), 2.83-2.52 (m, 2H, CH₂), 2.48-2.25 (m, 2H, CH₂), 2.20-1.76 (m, 2H, CH₂). ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 197.1 (C=O), 166.2 (C), 147.0 (C), 144.9 (C), 144.0 (C), 143.6 (C), 133.5 (C), 132.4 (C), 128.4 (CH), 128.0 (CH), 127.6 (CH), 126.5 (CH), 126.3 (CH), 126.1 (CH), 125.6 (CH), 117.4 (C), 114.0 (C), 108.5 (CH), 101.6 (CH₂), 98.3 (CH), 38.4 (CH), 37.1 (CH₂), 27.9 (CH₂), 20.5 (CH₂); IR (KBr) (ν_{max}/cm⁻¹): 3074, 3048, 2958, 2888, 2788, 1650, 1616, 1504, 1480, 1372, 1200, 1186, 1148, 1032, 1000, 932, 888, 750, 674, 590, 532, 478; HRMS (ESI) *m/z* calcd for C₂₄H₁₈O₄ (M+H)⁺ 371.1278, found 371.1328.

10-(2-Hydroxyphenyl)-6,7,8,10-tetrahydro-9H-[1,3]-dioxolo[4,5-*b*]xanthen-9-one (51). Yield (86%) as a white solid; mp 219-222 °C; ¹H NMR (200 MHz, Pyridine-*d*₅): δ_H (ppm) 8.70 (s, 1H, OH), 7.27 (bs, 1H, Ar-H), 7.22-6.99 (m, 3H, Ar-H), 6.93-6.72 (m, 2H, Ar-H), 6.10-5.64 (m, 3H, OCH₂O, CH), 2.73-2.39 (s, 2H, CH₂), 2.38-2.14 (m, 2H, CH₂), 1.92-1.56 (m, 2H, CH₂). ¹³C NMR (50 MHz, Pyridine-*d*₅): δ_C (ppm) 196.7 (C=O), 167.3 (C), 155.0 (C), 146.8 (C), 144.9 (C), 144.0 (C), 134.4 (C), 128.8 (CH), 127.6 (CH), 120.0 (CH), 118.9 (C), 116.6 (CH), 113.3 (C), 108.3 (CH), 101.7 (CH₂), 98.1 (CH), 37.0 (CH₂), 31.4 (CH), 27.7 (CH₂), 20.4 (CH₂); IR (KBr) (ν_{max}/cm⁻¹): 3378, 3064, 3030, 2952, 2890, 2788, 1714, 1640, 1480, 1458, 1382, 1270, 1226, 1188, 1036, 1000, 936, 842, 752, 610, 594, 532; HRMS (ESI) *m/z* calcd for C₂₀H₁₆O₅ (M+H)⁺ 337.1071, found 337.1112.

10-(4-Fluorophenyl)-8,8-dimethyl-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (52). Yield (85%) as a white solid; mp 198-200 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.23-7.06 (m, 2H, ArH), 6.97-6.78 (m, 2H, ArH), 6.59 (s, 1H, ArH), 6.45 (s, 1H, ArH), 5.90 (bs, 1H, OCH₂O), 5.86 (bs, 1H, OCH₂O), 4.88 (s, 1H, CH), 2.83-2.49 (m, 2H, CH₂), 1.85 (t, 2H, *J* = 6.3 Hz, CH₂), 1.10 (s, 3H, CH₃), 1.01 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 202.0

(C=O), 164.2 (C), 161.5 (d, J_{C-F} = 243.6 Hz, C), 147.0 (C), 144.9 (C), 143.9 (C), 142.3 (d, J_{C-F} = 2.6 Hz, C), 129.3 (d, J_{C-F} = 7.9 Hz, 2xCH), 117.3 (C), 115.3 (d, J_{C-F} = 21.5 Hz, 2xCH), 112.0 (C), 108.3 (CH), 101.6 (CH₂), 98.3 (CH), 40.4 (C), 38.0 (CH), 34.1 (CH₂), 24.9 (CH₂), 24.7 (CH₃), 24.4 (CH₃); IR (KBr) ($\nu_{\max}/\text{cm}^{-1}$): 2966, 2928, 2902, 2864, 1652, 1624, 1602, 1506, 1438, 1374, 1330, 1246, 1142, 1090, 1034, 964, 936, 846, 788, 764, 656, 588, 548, 532; HRMS (ESI) m/z calcd for C₂₂H₁₉FO₄ (M+H)⁺ 367.1340, found 367.1370.

10-(3-Methoxyphenyl)-8,8-dimethyl-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (53). Yield (80%) as a white solid; mp 120-121 °C; ¹H NMR (200 MHz, CDCl₃): δ_{H} (ppm) 7.15 (t, 1H, J = 7.8 Hz, ArH), 6.94-6.63 (m, 3H, ArH), 6.58 (s, 1H, ArH), 6.52 (s, 1H, ArH), 5.89 (bs, 1H, OCH₂O), 5.84 (bs, 1H, OCH₂O), 4.87 (s, 1H, CH), 3.75 (s, 3H, CH₃), 2.78-2.49 (m, 2H, CH₂), 1.87 (t, 2H, J = 6.2 Hz, CH₂), 1.11 (s, 3H, CH₃), 1.04 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_{C} (ppm) 201.9 (C=O), 164.3 (C), 159.8 (C), 148.2 (C), 146.9 (C), 144.8 (C), 143.8 (C), 129.5 (CH), 120.3 (CH), 117.4(C), 113.9 (CH), 111.9 (C), 111.4 (CH), 108.3 (CH), 101.6 (CH₂), 98.2 (CH), 55.2 (CH₃), 40.5 (C), 38.7 (CH), 34.1 (CH₂), 24.9 (CH₂), 24.8 (CH₃), 24.5 (CH₃); IR (KBr) ($\nu_{\max}/\text{cm}^{-1}$): 3052, 3024, 2966, 2932, 2900, 2838, 2776, 1652, 1624, 1582, 1482, 1438, 1374, 1314, 1268, 1188, 1136, 1036, 958, 936, 838, 768, 742, 700, 548; HRMS (ESI) m/z calcd for C₂₃H₂₂O₅ (M+H)⁺ 379.1540, found 379.1579.

8,8-Dimethyl-10-phenyl-6,7,8,10-tetrahydro-9H-[1,3]-dioxolo[4,5-*b*]xanthen-9-one (54). Yield (69%) as a white solid; mp 165-167 °C; ¹H NMR (200 MHz, CDCl₃): δ_{H} (ppm) 7.51-6.90 (m, 5H, ArH), 6.60 (s, 1H, ArH), 6.51 (s, 1H, ArH), 5.88 (bs, 1H, OCH₂O), 5.83 (bs, 1H, OCH₂O), 4.92 (s, 1H, CH), 2.86-2.48 (m, 2H, CH₂), 2.64-2.02 (m, 2H, CH₂), 1.12 (s, 3H, CH₃), 1.03 (s, 3H, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_{C} (ppm) 201.9 (C=O), 164.1 (C), 146.9 (C), 146.5 (C), 144.8 (C), 143.9 (C), 128.5 (2xCH), 127.8 (2xCH), 126.4 (CH), 117.6 (C), 112.1 (C), 108.4 (CH), 101.6 (CH₂), 98.2 (CH), 40.4 (C), 38.7 (CH), 34.1 (CH₂), 24.9 (CH₂), 24.7 (CH₃), 24.4 (CH₃); IR (KBr) ($\nu_{\max}/\text{cm}^{-1}$): 3052, 3030, 2968, 2928, 2870, 2782, 1652, 1624, 1504, 1480, 1438, 1374, 1326, 1226, 1188, 1142, 1034, 962, 934, 870, 842, 698, 552; HRMS (ESI) m/z calcd for C₂₂H₂₀O₄ (M+H)⁺ 349.1434, found 349.1449.

8,8-Dimethyl-10-(4-methoxyphenyl)-6,7,8,10-tetrahydro-9H-[1,3]-dioxolo[4,5-*b*]xanthen-9-one (55). Yield (73%) as a white solid; mp 155-157 °C; ¹H NMR (200 MHz, CDCl₃): δ_{H} (ppm) 7.13 (d, 2H, J = 8.5 Hz Ar-H), 6.77 (d, 2H, J = 8.5 Hz Ar-H), 6.58 (s, 1H, Ar-H), 6.49 (s, 1H, Ar-H), 5.89 (bs, 1H, OCH₂O), 5.84 (bs, 1H, OCH₂O), 4.86 (s, 1H, CH), 3.73 (s, 3H, CH₃), 2.80-2.45 (m, 2H, CH₂), 2.00-1.64 (m, 2H, CH₂), 1.11 (s, 3H, CH₃), 1.02 (s, 3H, CH₃). ¹³C NMR (50 MHz, CDCl₃): δ_{C} (ppm) 202.0 (C=O), 163.9 (C), 158.1 (C), 146.8 (C), 144.8 (C), 143.9 (C), 139.0 (C), 128.8 (2xCH), 117.9 (C), 113.9 (2xCH), 112.3 (C), 108.4 (CH), 101.6 (CH₂), 98.2 (CH), 55.3 (CH₃), 40.5 (C), 37.9 (CH), 34.1 (CH₂), 24.9 (CH₂), 24.7 (CH₃), 24.4 (CH₃); IR (KBr) ($\nu_{\max}/\text{cm}^{-1}$): 3066, 3046, 2980, 2958, 2926, 2902, 2832, 1650, 1620, 1508, 1482, 1438,

1378, 1326, 1260, 1230, 1190, 1144, 1114, 1034, 956, 936, 878, 846, 550; HRMS (ESI) m/z calcd for $C_{23}H_{22}O_5$ (M+H)⁺ 379.1540, found 379.1601.

8,8-Dimethyl-10-(4-hydroxyphenyl)-7,8-dihydro-6H [1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (56). Yield (66%) as a white solid; mp 244-246 °C; ¹H NMR (200 MHz, Pyridine-*d*₅): δ_H (ppm) 11.3 (bs, 1H, OH), 7.41 (d, 2H, $J = 8.4$ Hz, Ar-H), 7.10 (d, 2H, $J = 8.4$ Hz Ar-H), 6.87 (s, 1H, Ar-H), 6.80 (s, 1H, Ar-H), 5.96 (bs, 1H, OCH₂O), 5.88 (bs, 1H, OCH₂O), 5.18 (s, 1H, CH), 2.91-2.44 (m, 2H, CH₂), 1.90-1.54 (m, 2H, CH₂), 1.11 (s, 3H, CH₃), 1.01 (s, 3H, CH₃); ¹³C NMR (50 MHz, Pyridine-*d*₅): δ_C (ppm) 202.4 (C=O), 165.2 (C), 158.7 (C), 148.3 (C), 146.3 (C), 145.3 (C), 139.4 (C), 130.6 (2xCH), 119.9 (C), 117.7 (2xCH), 113.5 (C), 109.9 (CH), 103.2 (CH₂), 99.6(CH), 41.6 (C), 39.4 (CH), 35.3 (CH₂), 26.0 (CH₂), 25.9 (CH₃), 25.6 (CH₃); IR (KBr) (ν_{max}/cm^{-1}): 3282, 3020, 2964, 2932, 2902, 2774, 1636, 1606, 1510, 1480, 1440, 1382, 1244, 1188, 1140, 1112, 1034, 996, 934, 844, 768, 670, 554, 460; HRMS (ESI) m/z calcd for $C_{22}H_{20}O_5$ (M+H)⁺ 365.1384, found 365.1351.

8,8-Dimethyl-10-(4-(methylthio)phenyl)-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (57). Yield (82%) as a white solid; mp 175-176 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.13 (bs, 4H, Ar-H), 6.58 (s, 1H, ArH), 6.46 (s, 1H, ArH), 5.88 (d, 1H, $J = 1.0$ Hz, OCH₂O), 5.83 (d, 1H, $J = 1.0$ Hz, OCH₂O), 4.89 (s, 1H, CH), 2.78-2.52 (m, 2H, CH₂), 2.40 (m, 3H, CH₃), 2.00-1.68 (m, 2H, CH₂), 1.10 (s, 3H, CH₃), 1.02 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 201.7 (C=O), 163.9 (C), 146.6 (C), 144.5 (C), 143.5 (C), 143.4 (C), 135.8 (C), 128.0 (2xCH), 126.7 (2xCH), 117.0 (C), 111.6 (C), 108.0 (CH), 101.3 (CH₂), 97.9 (CH), 40.1 (C), 37.9 (CH), 33.8 (CH₂), 24.6 (CH₂), 24.4 (CH₃), 24.1 (CH₃), 15.8 (CH₃); IR (KBr) (ν_{max}/cm^{-1}): 3078, 2982, 2962, 2914, 2776, 1652, 1624, 1506, 1482, 1436, 1376, 1328, 1230, 1192, 1146, 1092, 1038, 960, 938, 876, 848, 772, 584, 550; HRMS (ESI) m/z calcd for $C_{23}H_{22}SO_4$ (M+H)⁺ 395.1540, found 395.1301.

8,8-Dimethyl-10-(benzo[*d*][1,3]dioxol-5-yl)-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (58). Yield (76%) as a white solid; mp 201-202 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 6.79-6.60 (m, 3H, Ar-H), 6.56 (s, 1H, Ar-H), 6.49 (s, 1H, Ar-H), 6.02-5.58 (m, 4H, 2xOCH₂O), 4.81 (s, 1H, CH), 2.78-2.47 (m, 2H, CH₂), 2.00-1.67 (m, 2H, CH₂), 1.10 (s, 3H, CH₃), 1.04 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 201.9 (C=O), 164.1 (C), 147.7 (C), 146.8 (C), 146.0 (C), 144.7 (C), 143.7 (C), 140.7 (C), 120.8 (CH), 117.6 (C), 111.9 (C), 108.2 (3xCH), 101.6(CH₂), 100.9 (CH₂), 98.2 (CH), 40.4 (C), 38.3 (CH), 34.1 (CH₂), 24.8 (CH₂), 24.7 (CH₃), 24.4 (CH₃); IR (KBr) (ν_{max}/cm^{-1}): 3068, 3048, 2968, 2930, 1646, 1620, 1558, 1482, 1440, 1378, 1232, 1190, 1146, 1036, 960, 936, 764, 670, 550; HRMS (ESI) m/z calcd for $C_{23}H_{20}O_6$ (M+H)⁺ 393.1333, found 393.1310.

8,8-Dimethyl-10-(4-chlorophenyl)-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (59). Yield (89%) as a yellow solid; mp 190-192 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm)

7.26-7.04 (m, 4H, Ar-H), 6.59 (s, 1H, ArH), 6.44 (s, 1H, ArH), 5.91 (bs, 1H, OCH₂O), 5.86 (bs, 1H, OCH₂O), 4.87 (s, 1H, CH), 2.84-2.46 (m, 2H, CH₂), 1.85 (t, 2H, *J* = 6.3 Hz CH₂), 1.10 (s, 3H, CH₃), 1.01 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 202.0 (C=O), 164.3 (C), 147.1(C), 145.1 (C), 144.9 (C), 143.9 (C), 132.2 (C), 129.3 (2xCH), 128.7 (2xCH), 117.0 (C), 111.8 (C), 108.3 (CH), 101.7 (CH₂), 98.3 (CH), 40.5 (C), 38.3 (CH), 34.1 (CH₂), 24.9 (CH₂), 24.7 (CH₃), 24.4 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3028, 2960, 2926, 2868, 2786, 1654, 1622, 1504, 1486, 1438, 1408, 1372, 1330, 1230, 1190, 1140, 1092, 1034, 962, 934, 840, 768, 584, 466; HRMS (ESI) *m/z* calcd for C₂₂H₁₉ClO₄ (M+H)⁺ 383.1045, found 383.1021.

8,8-Dimethyl-10-(naphthalen-1-yl)-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (60). Yield (84%) as a white solid; mp 184-185 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 8.68 (d, 1H, *J* = 8.2 Hz, ArH), 7.87 (d, 1H, *J* = 8.1 Hz, ArH), 7.76-7.59 (m, 2H, ArH), 7.57-7.20 (m, 3H, ArH), 6.66 (s, 1H, ArH), 6.54 (s, 1H, ArH), 5.92-5.77 (bs, 2H, OCH₂O), 5.71 (s, 1H, CH), 2.98-2.54 (m, 2H, CH₂), 1.92 (t, 2H, *J* = 6.2 Hz, CH₂), 1.15 (s, 3H, CH₃), 1.01 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 201.9 (C=O), 164.2 (C), 146.8 (C), 144.5 (C), 143.7 (C), 143.1 (C), 134.0 (C), 131.2 (C), 128.9 (CH), 127.1 (CH), 126.5 (CH), 126.1 (CH), 125.7 (CH), 125.6 (CH), 123.5 (CH), 118.2 (C), 112.4 (C), 107.6 (CH), 101.4 (CH₂), 98.2 (CH), 40.4 (C), 34.2 (CH₂), 33.4 (CH), 24.9 (CH₂), 24.4 (2xCH₃); IR (KBr) (ν_{max}/cm⁻¹): 3056, 3010, 2958, 2902, 2854, 2774, 1712, 1656, 1622, 1502, 1480, 1374, 1322, 1226, 1188, 1142, 1040, 960, 936, 836, 784, 738, 616, 546, 492; HRMS (ESI) *m/z* calcd for C₂₆H₂₂O₄ (M+H)⁺ 399.1591, found 399.1611.

10-(4-Hydroxy-3,5-dimethoxyphenyl)-8,8-dimethyl-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (61). Yield (71%) as a white solid; mp 193-195 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 6.56 (s, 1H, ArH), 6.51 (s, 1H, ArH), 6.41 (s, 2H, ArH), 5.88 (bs, 1H, OCH₂O), 5.84 (bs, 1H, OCH₂O), 5.46 (bs, 1H, OH), 4.79 (s, 1H, CH), 3.79 (s, 6H, 2xCH₃), 2.77-2.46 (m, 2H, CH₂), 1.85 (t, 2H, *J* = 6.1 Hz, CH₂), 1.08 (s, 3H, CH₃), 1.03 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 202.0 (C=O), 164.0 (C), 147.0 (2xC), 146.8 (C), 144.7 (C), 143.7(C), 137.9 (C), 133.4 (C), 117.5 (C), 112.0 (C), 108.2 (CH), 104.5 (2xCH), 101.6 (CH₂), 98.1 (CH), 56.3 (2xCH₃), 40.5 (C), 38.6 (CH), 34.2 (CH₂), 24.8 (CH₂), 24.7 (CH₃), 24.4 (CH₃); IR (KBr) (ν_{max}/cm⁻¹): 3398, 2958, 2928, 2892, 2838, 2784, 1652, 1620, 1518, 1482, 1428, 1376, 1328, 1228, 1192, 1122, 1026, 966, 922, 862, 834, 772, 742, 682, 580; HRMS (ESI) *m/z* calcd for C₂₄H₂₄O₇ (M+H)⁺ 425.1595, found 425.1580.

8,8-Dimethyl-10-(naphthalen-2-yl)-7,8-dihydro-6H-[1,3]dioxolo[4,5-*b*]xanthen-9(10H)-one (62). Yield (90%) as a yellow solid; mp 173-175 °C; ¹H NMR (200 MHz, CDCl₃): δ_H (ppm) 7.84-7.50 (m, 4H, ArH), 7.46-7.09 (m, 3H, ArH), 6.53 (s, 1H, ArH), 6.42 (s, 1H, ArH), 5.79 (bs, 1H, OCH₂O), 5.72 (bs, 1H, OCH₂O), 4.98 (s, 1H, CH), 2.72-2.45 (m, 2H, CH₂), 1.76 (t, 2H, *J* = 5.9 Hz, CH₂), 1.01 (s, 3H, CH₃), 0.89 (s, 3H, CH₃); ¹³C NMR (50 MHz, CDCl₃): δ_C (ppm) 202.0 (C=O), 164.3 (C), 147.0 (C), 144.8 (C), 143.9 (C), 143.8 (C), 133.6 (C), 132.4 (C), 128.4(CH),

128.1 (CH), 127.7 (CH), 126.4 (CH), 126.3 (CH), 126.0 (CH), 125.6 (CH), 117.4 (C), 111.9 (C), 108.5 (CH), 101.6 (CH₂), 98.3 (CH), 40.5 (C), 39.0 (CH), 34.1 (CH₂), 24.9 (CH₂), 24.7 (CH₃), 24.4 (CH₃); IR (KBr) ($\nu_{\max}/\text{cm}^{-1}$): 3052, 3030, 2968, 2928, 2870, 2782, 1652, 1624, 1504, 1480, 1438, 1374, 1326, 1226, 1188, 1142, 1034, 962, 934, 870, 842, 772, 738, 698, 580, 478; HRMS (ESI) m/z calcd for C₂₆H₂₂O₄ (M+H)⁺ 399.1591, found 399.1573.