Supporting Information

Tetramethylguanidium-based ionic liquids as efficient and reusable catalyst for the synthesis of biscoumarin at room temperature

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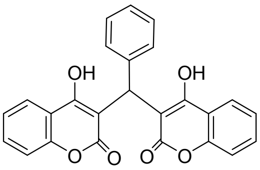
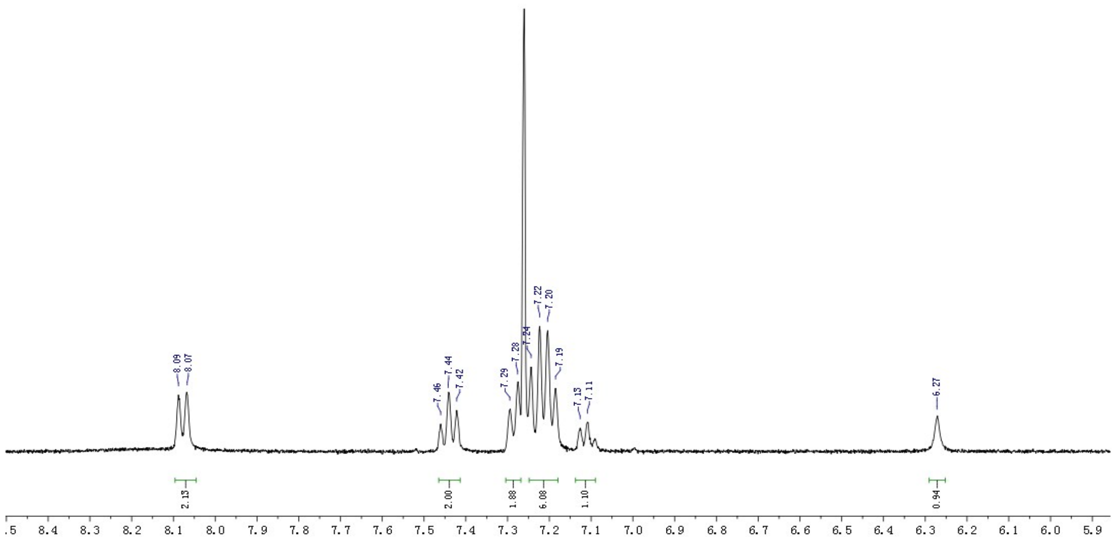
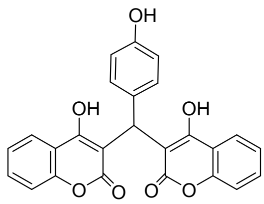
^{1}H-NMR spectra were recorded on a BRUKER AV-400 instrument at room temperature. Chemical shifts (δ) are expressed in ppm from the internal standard tetramethylsilane and coupling constants (*J*) are given in Hz.



3a.

3,3′-(Phenylmethylene)bis-(4-hydroxy-2H-chromen-2-one)
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08 (d, *J* = 8.4 Hz, 2H), 7.44 (t, *J* = 7.7 Hz, 2H), 7.29 (d, *J* = 7.5 Hz, 2H), 7.21 (dd, *J* = 15.5, 7.9 Hz, 6H), 7.12 (d, *J* = 7.0 Hz, 1H), 6.27 (s, 1H).

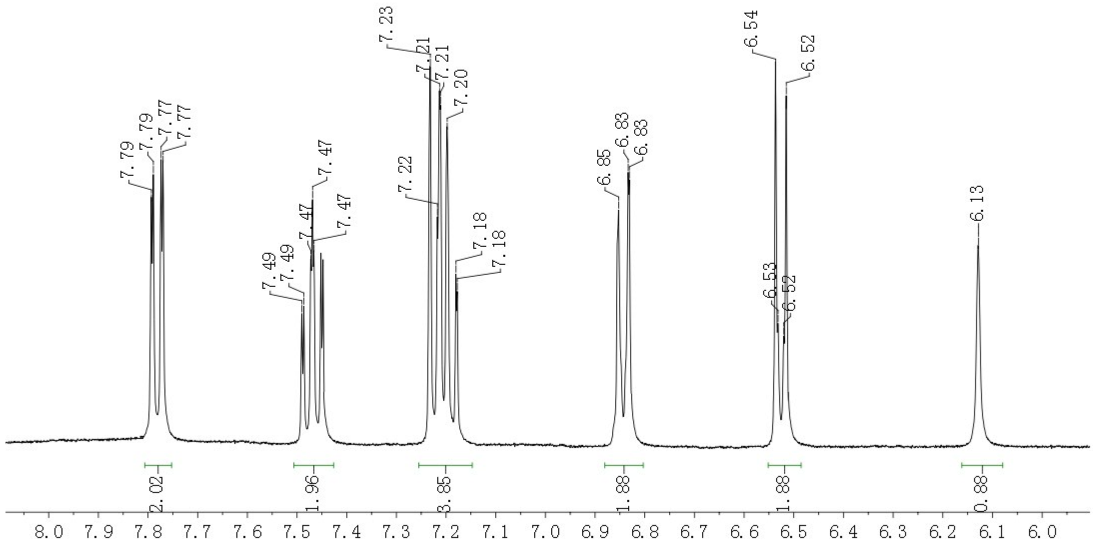


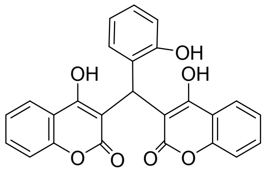


3b.

3,3′-(4-Hydroxylphenylmethylene)bis-(4-hydroxy-2H-chromen-2-one)

[1]H NMR (400 MHz, DMSO) δ 7.78 (dd, J = 7.8, 1.6 Hz, 2H), 7.50 – 7.43 (m, 2H), 7.24 – 7.17 (m, 4H), 6.84 (d, J = 7.8 Hz, 2H), 6.53 (d, J = 8.6 Hz, 2H), 6.13 (s, 1H).

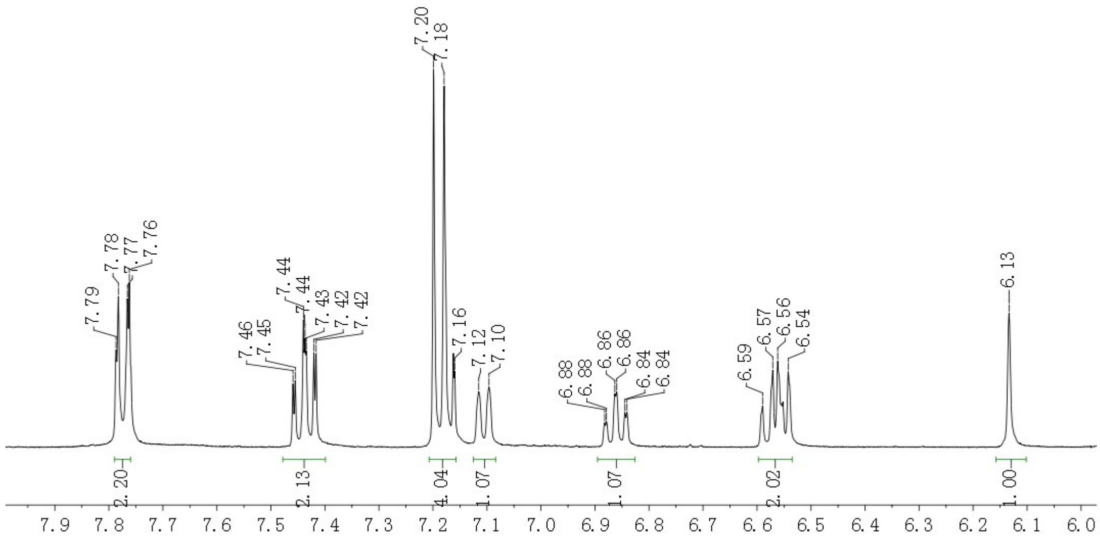


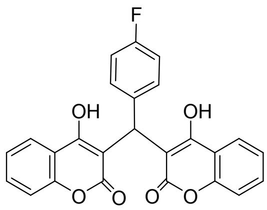


3c.

3,3′-(2-Hydroxylphenylmethylene)bis-(4-hydroxy-2H-chromen-2-one)

[1]H NMR (400 MHz, DMSO) δ 7.77 (dd, J = 8.3, 1.6 Hz, 2H), 7.48 – 7.40 (m, 2H), 7.18 (t, J = 7.8 Hz, 4H), 7.11 (d, J = 7.6 Hz, 1H), 6.86 (td, J = 7.5, 1.4 Hz, 1H), 6.57 (dd, J = 11.4, 7.7 Hz, 2H), 6.13 (s, 1H).

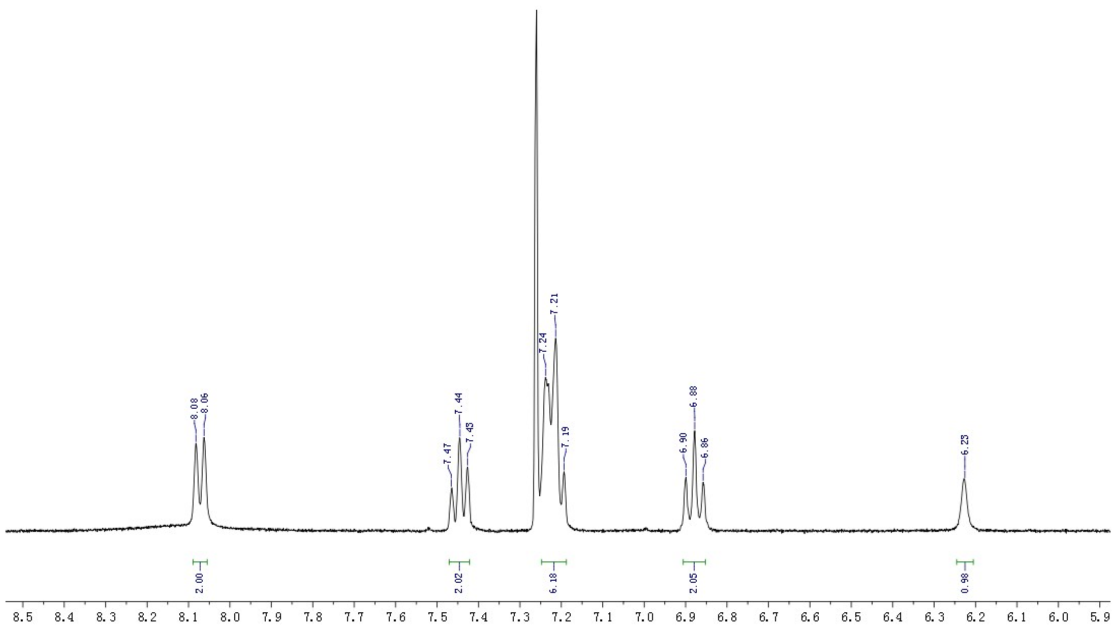


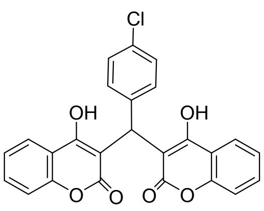


3d.

3,3′-(4-Fluorophenylmethylene)bis-(4-hydroxy-2H-chromen-2-one)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.07 (d, *J* = 7.8 Hz, 2H), 7.45 (t, *J* = 7.8 Hz, 2H), 7.22 (t, *J* = 8.9 Hz, 6H), 6.88 (t, *J* = 8.3 Hz, 2H), 6.23 (s, 1H).

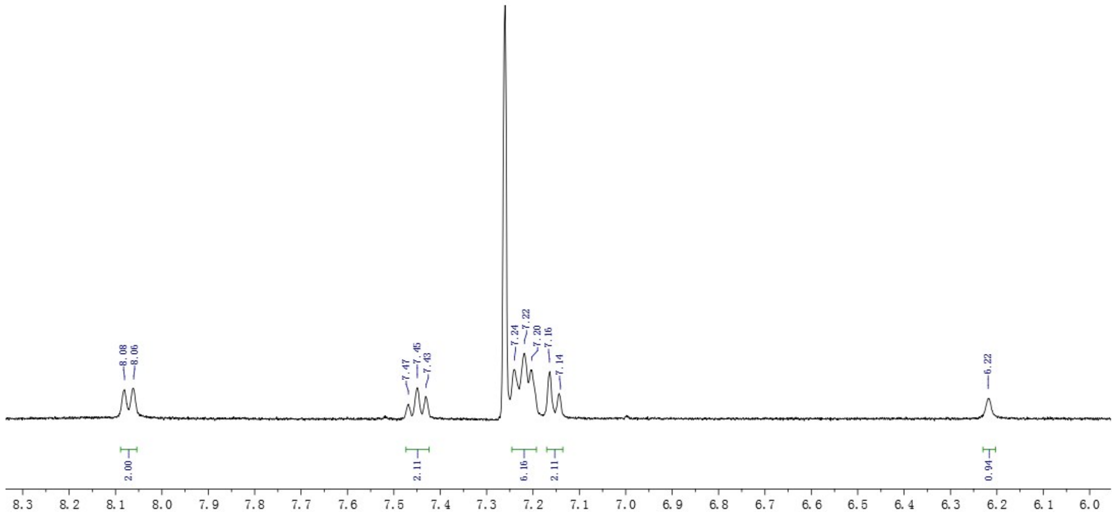


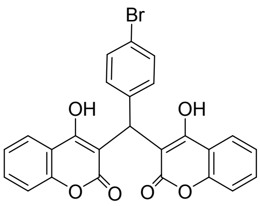


3e.

3,3′-(4-Chlorophenylmethylene)bis-(4-hydroxy-2H-chromen-2-one)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.07 (d, *J* = 7.9 Hz, 2H), 7.45 (t, *J* = 7.7 Hz, 2H), 7.25 – 7.19 (m, 6H), 7.15 (d, *J* = 9.5 Hz, 2H), 6.22 (s, 1H).

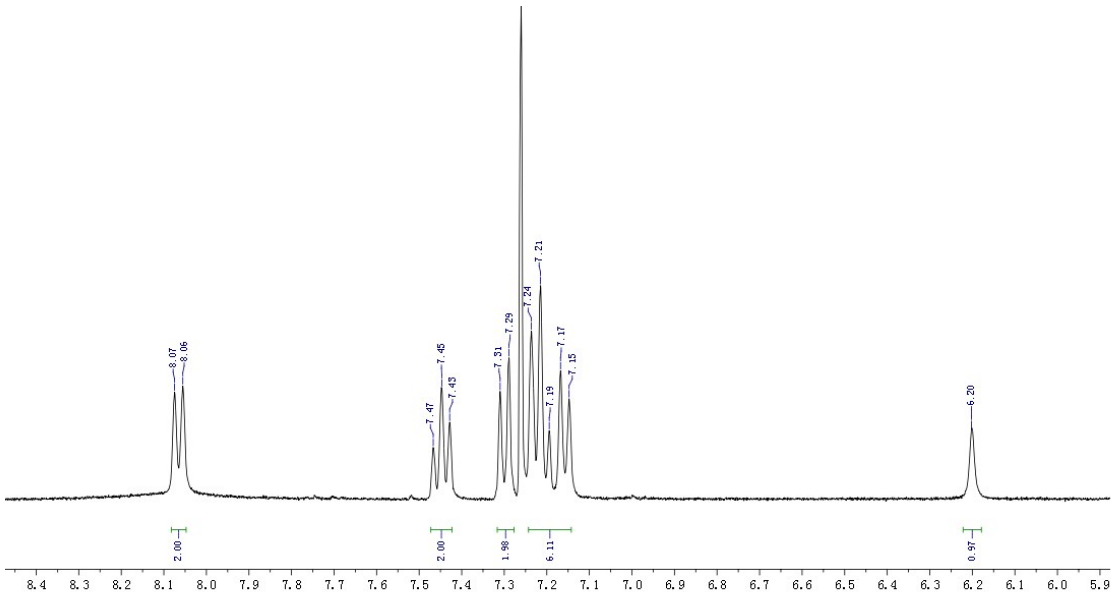




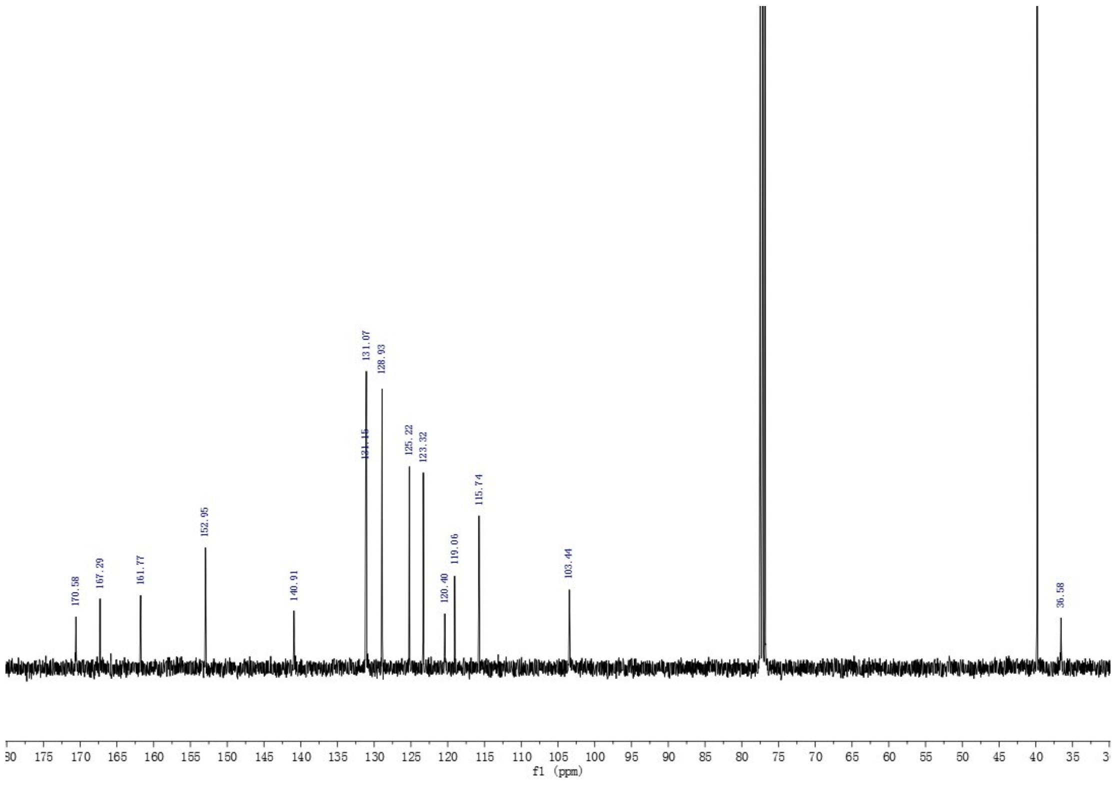
3f.

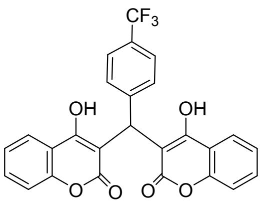
3,3′-(4-Bromophenylmethylene)bis-(4-hydroxy-2H-chromen-2-one)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.07 (d, *J* = 7.8 Hz, 2H), 7.45 (t, *J* = 7.7 Hz, 2H), 7.30 (d, *J* = 8.3 Hz, 2H), 6.20 (s, 1H).



^{13}C NMR (101 MHz, $CDCl_3$) δ: 170.58, 167.29, 161.77, 152.95, 140.91, 131.15, 131.07, 128.93, 125.22, 123.32, 120.40, 119.06, 115.74, 103.44, 36.58.

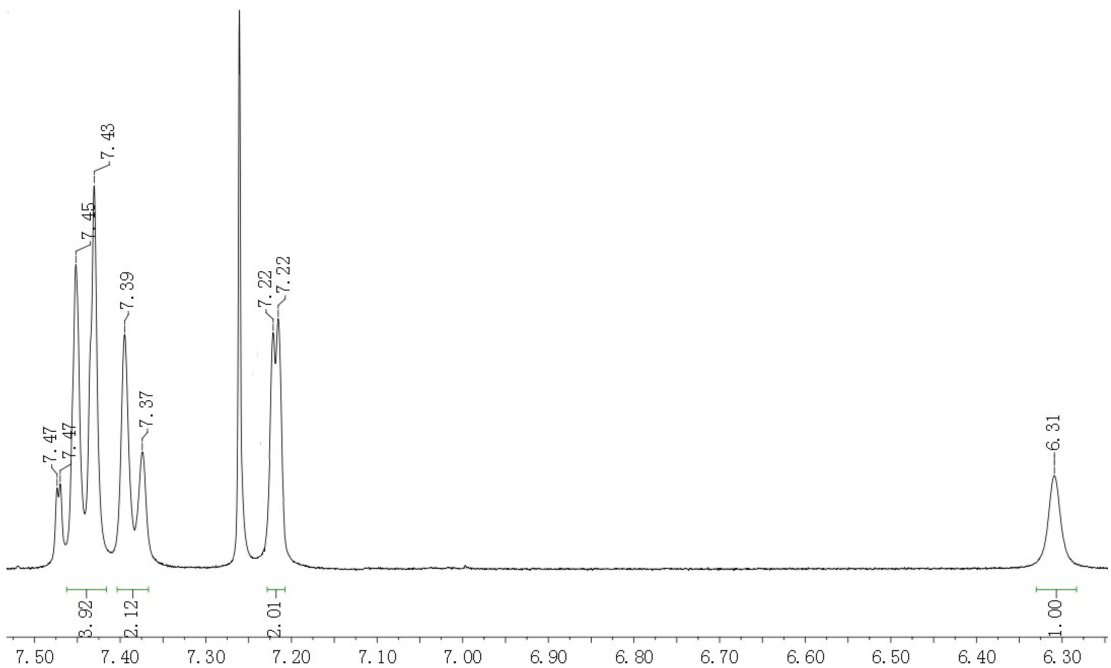


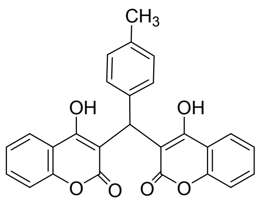


3g.

3,3′-(4-Trifluoromethylphenylmethylene)bis-(4-hydroxy-2H-chromen-2-one)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.05 (d, *J* = 7.9 Hz, 4H), 7.44 (d, *J* = 8.5 Hz, 4H), 7.38 (d, *J* = 8.2 Hz, 2H), 7.22 (d, *J* = 2.4 Hz, 2H), 6.31 (s, 1H).

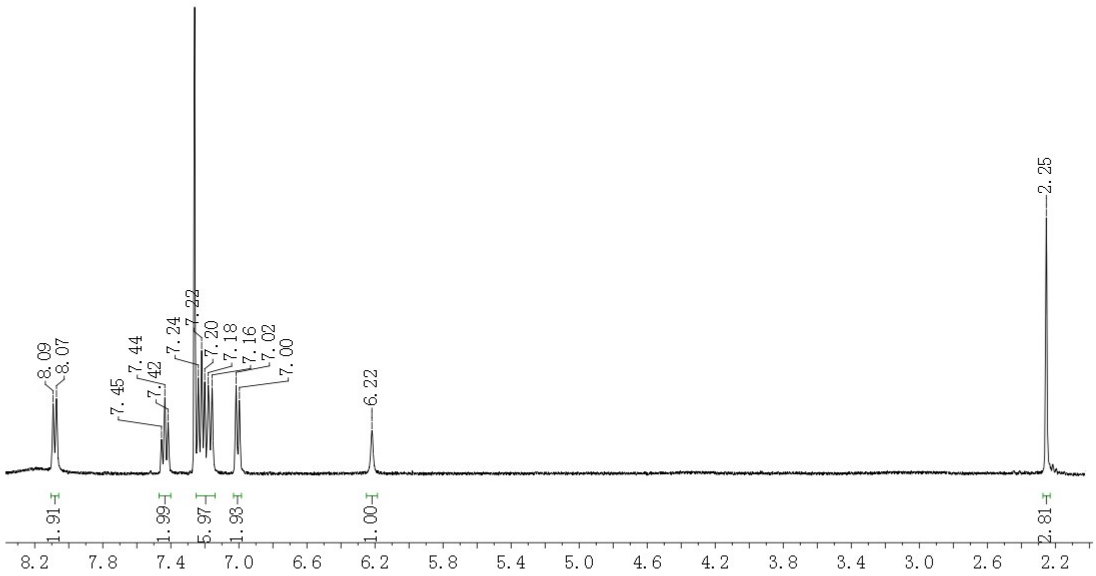


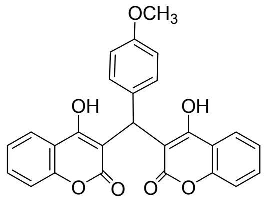


3h.

3,3′-(4-Methylphenylmethylene)bis-(4-hydroxy-2H-chromen-2-one)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08 (d, *J* = 7.9 Hz, 2H), 7.44 (t, *J* = 7.8 Hz, 2H), 7.25 – 7.14 (m, 6H), 7.01 (d, *J* = 7.9 Hz, 2H), 6.22 (s, 1H), 2.25 (s, 3H).

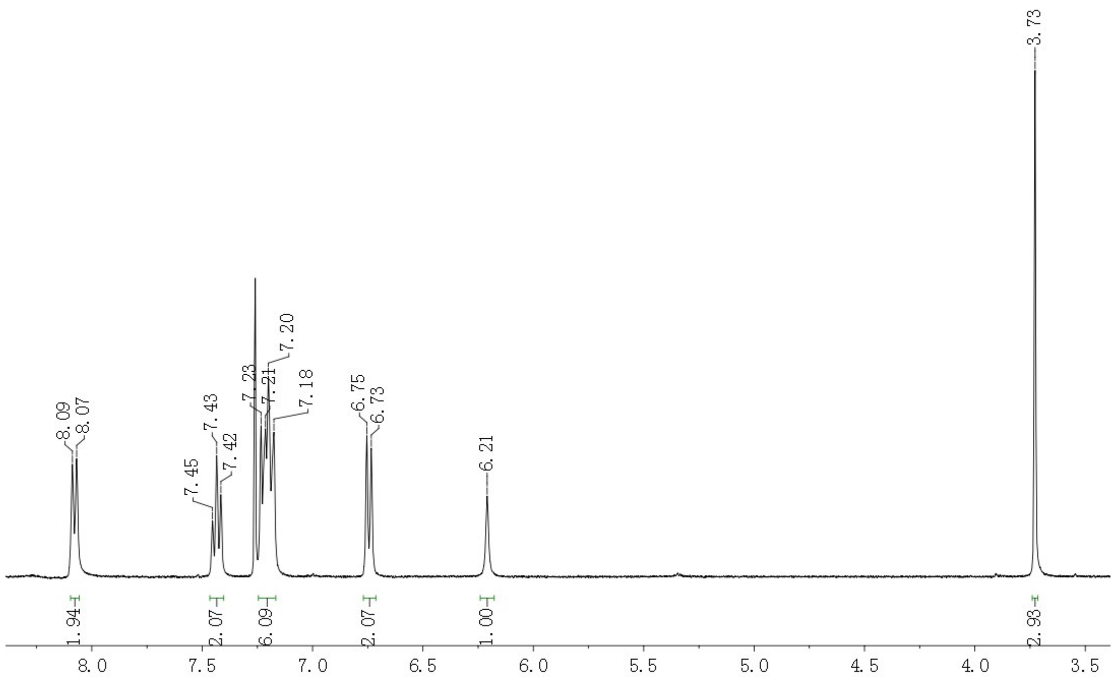


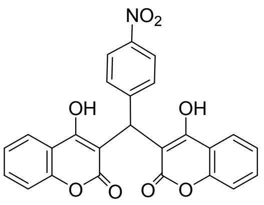


3i.

3,3′-(4-Methoxyphenylmethylene)bis-(4-hydroxy-2H-chromen-2-one)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08 (d, *J* = 7.6 Hz, 2H), 7.43 (t, *J* = 7.7 Hz, 2H), 7.21 (dd, *J* = 14.3, 9.1 Hz, 6H), 6.74 (d, *J* = 8.1 Hz, 2H), 6.21 (s, 1H), 3.73 (s, 3H).

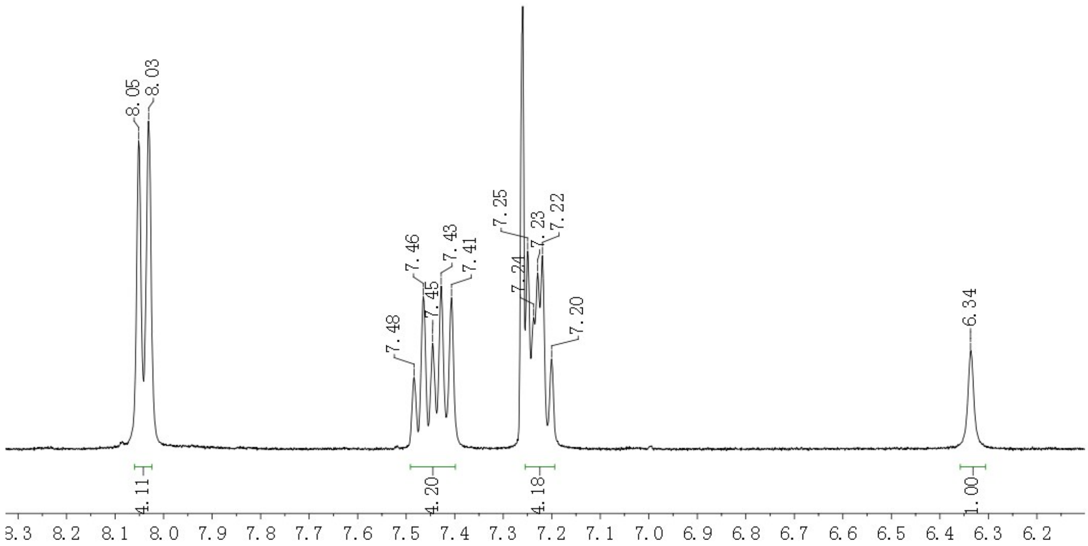


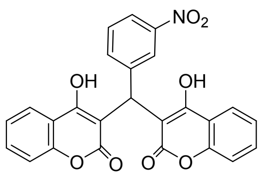


3j.

3,3′-(4-Nitrophenylmethylene)bis-(4-hydroxy-2H-chromen-2-one)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.04 (d, *J* = 8.1 Hz, 4H), 7.49 – 7.40 (m, 4H), 7.25 – 7.19 (m, 4H), 6.34 (s, 1H).

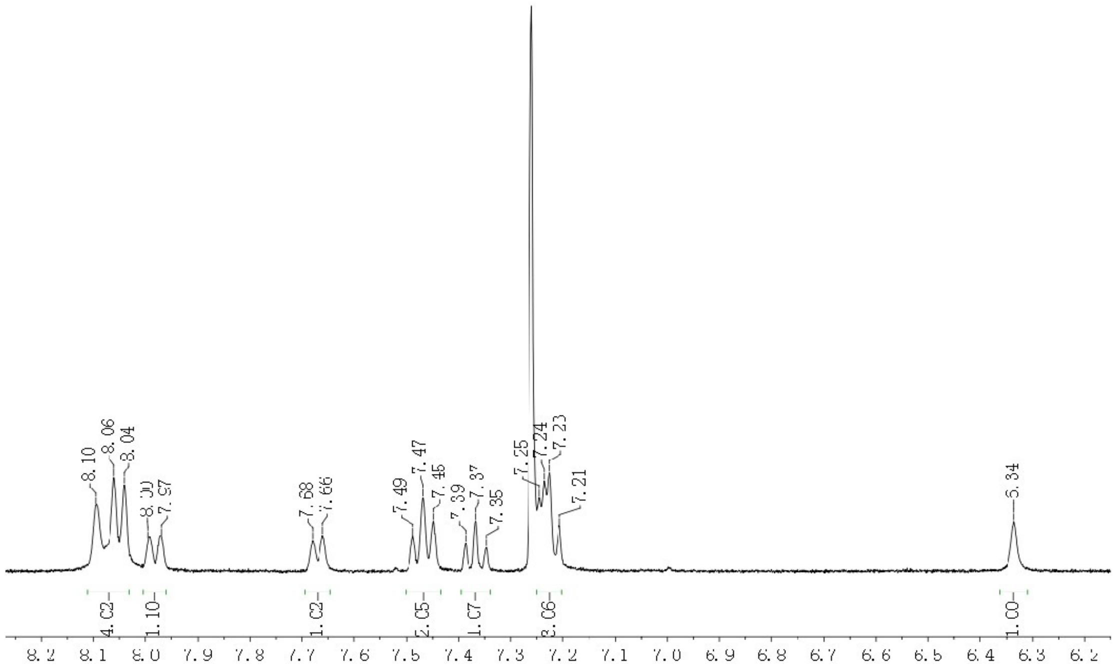


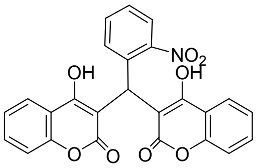


3k.

3,3′-(3-Nitrophenylmethylene)bis-(4-hydroxy-2H-chromen-2-one)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.11 – 8.03 (m, 4H), 7.98 (d, *J* = 10.0 Hz, 1H), 7.67 (d, *J* = 7.8 Hz, 1H), 7.47 (t, *J* = 7.6 Hz, 2H), 7.37 (t, *J* = 8.0 Hz, 1H), 7.23 (dd, *J* = 9.8, 6.0 Hz, 3H), 6.34 (s, 1H).

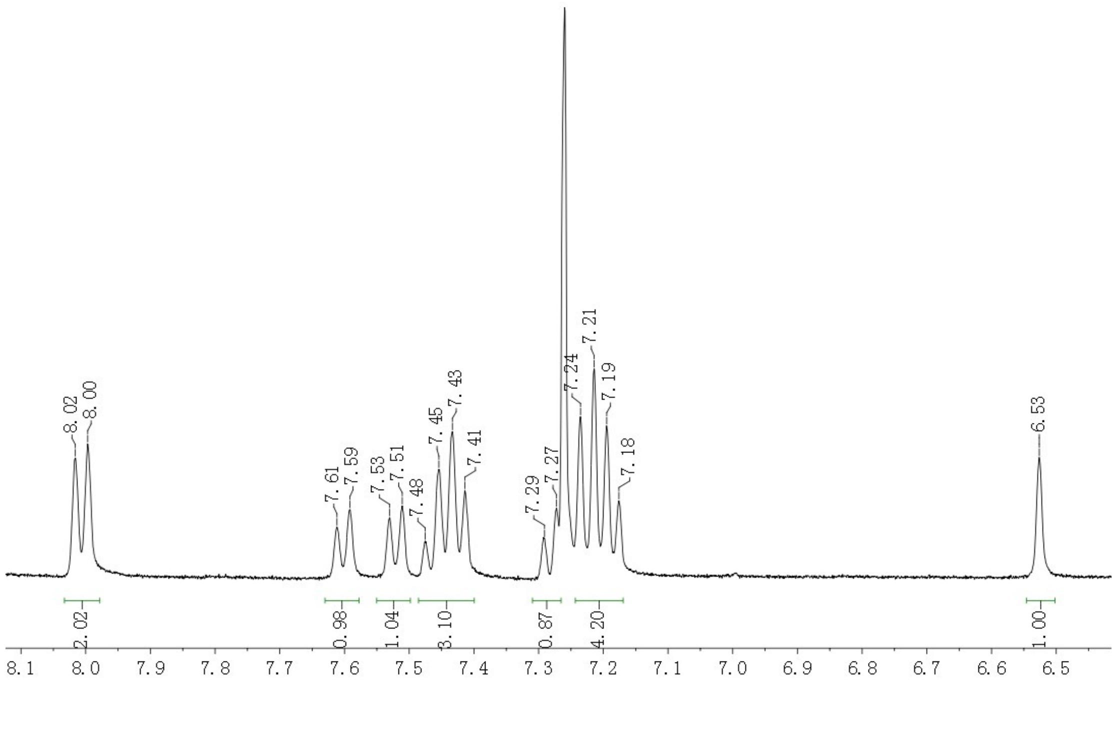


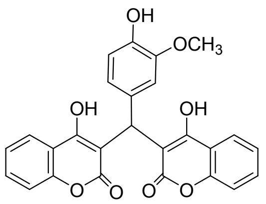


3l.

3,3′-(2-Nitrophenylmethylene)bis-(4-hydroxy-2H-chromen-2-one)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (d, J = 7.7 Hz, 2H), 7.60 (d, J = 8.1 Hz, 1H), 7.52 (d, J = 7.8 Hz, 1H), 7.44 (dd, J = 16.5, 8.1 Hz, 3H), 7.28 (d, J = 7.4 Hz, 1H), 7.20 (dd, J = 15.8, 8.0 Hz, 4H), 6.53 (s, 1H).

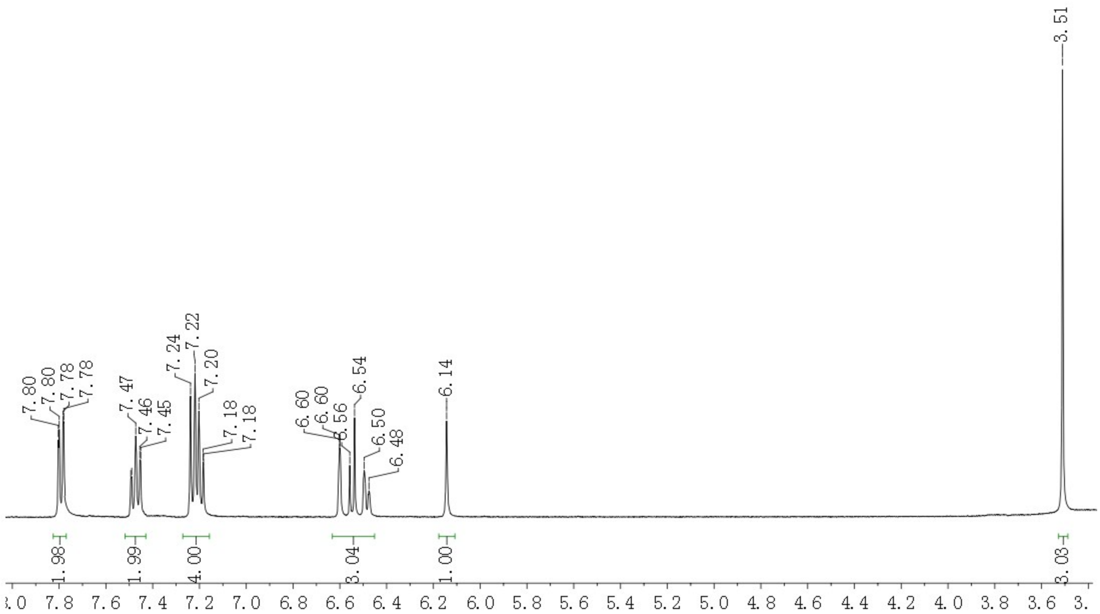


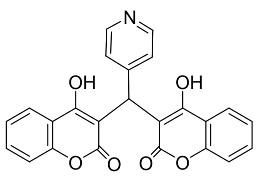


3m.

3,3′-(4-Hydroxy-3-methoxyphenylmethylene)bis-(4-hydroxy-2H-chromen-2-one)

[1]H NMR (400 MHz, DMSO) δ 7.79 (dd, *J* = 7.8, 1.4 Hz, 2H), 7.52 – 7.43 (m, 2H), 7.27 – 7.16 (m, 4H), 6.63 – 6.45 (m, 3H), 6.14 (s, 1H), 3.51 (s, 3H).

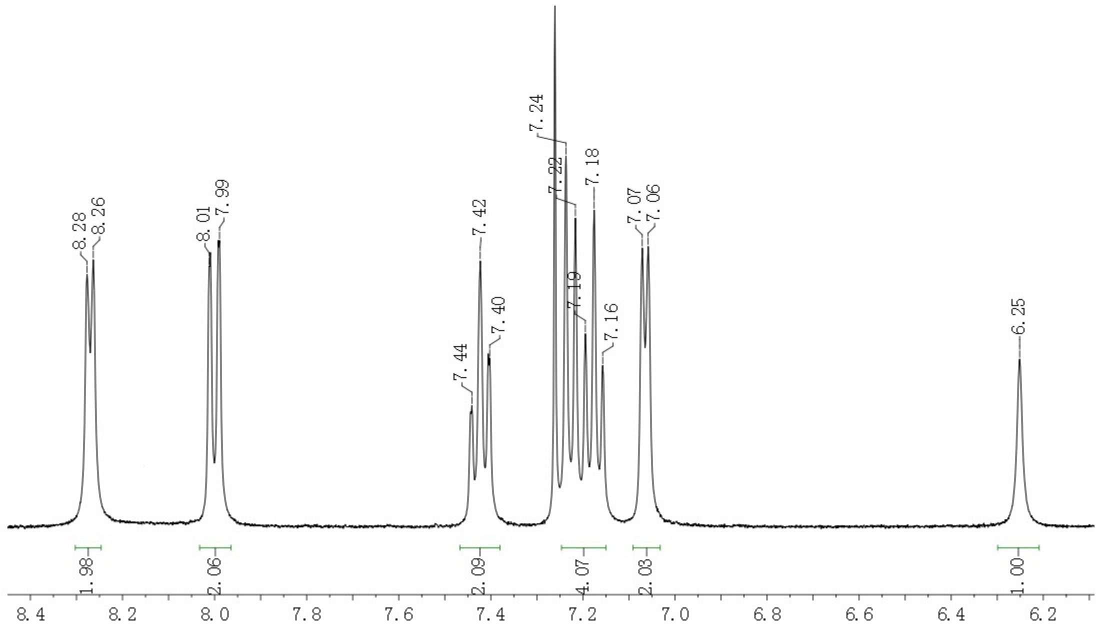


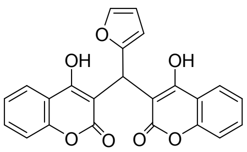


3n.

3,3′-(N-pyridylmethylene)bis-(4-hydroxy-2H-chromen-2-one)

[1]H NMR (400 MHz, $CDCl_3$) δ 8.27 (d, *J* = 5.5 Hz, 2H), 8.00 (d, *J* = 8.9 Hz, 2H), 7.42 (t, *J* = 7.7 Hz, 2H), 7.25 – 7.15 (m, 4H), 7.06 (d, *J* = 5.1 Hz, 2H), 6.25 (s, 1H).

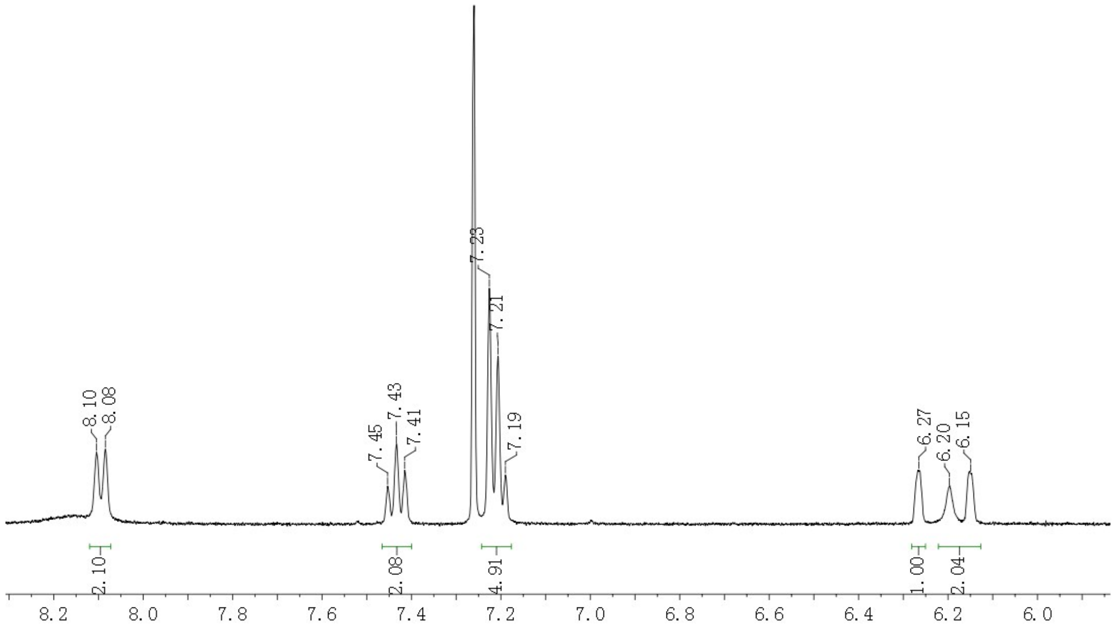


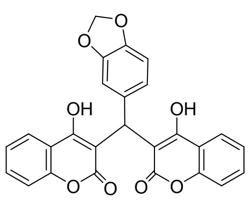


3o.

3,3'-(furan-2-ylmethylene)bis(4-hydroxy-2H-chromen-2-one)

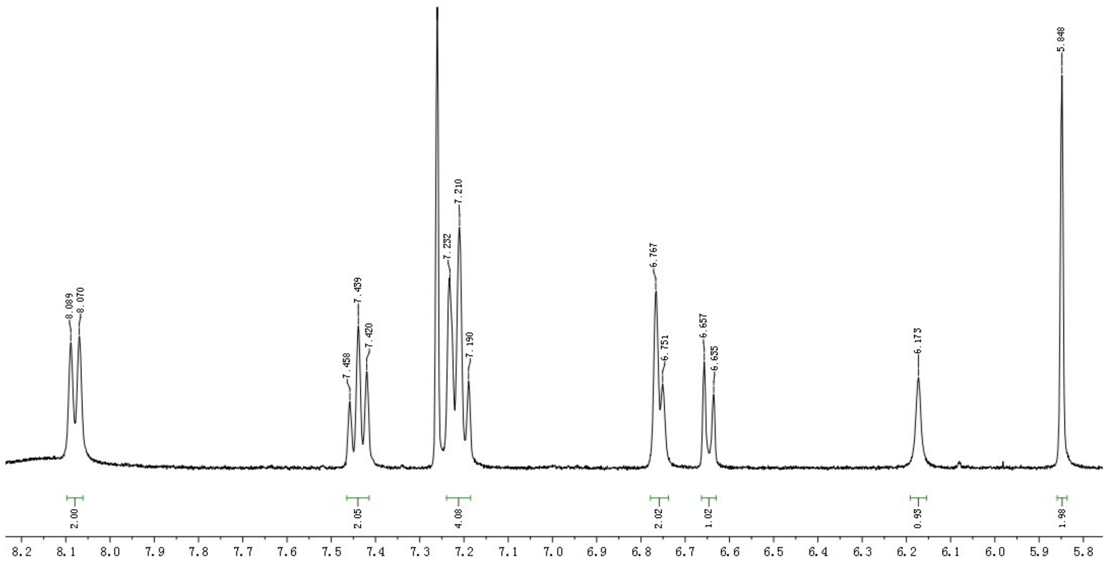
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.09 (d, *J* = 7.9 Hz, 2H), 7.43 (t, *J* = 7.7 Hz, 2H), 7.24 – 7.18 (m, 5H), 6.27 (s, 1H), 6.17 (d, *J* = 19.0 Hz, 2H).



3p. 

3,3'-(benzo[d][1,3]dioxol-5-ylmethylene)bis(4-hydroxy-2H-chromen-2-one)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08 (d, *J* = 7.6 Hz, 2H), 7.44 (t, *J* = 7.6 Hz, 2H), 7.21 (t, *J* = 8.5 Hz, 4H), 6.76 (d, *J* = 6.2 Hz, 2H), 6.65 (d, *J* = 8.6 Hz, 1H), 6.17 (s, 1H), 5.85 (s, 2H).



^{13}C NMR (101 MHz, $CDCl_3$) δ: 170.77, 167.44, 161.80, 152.84, 147.55, 145.22, 135.50, 130.95, 125.30, 123.18, 120.48, 119.55, 115.58, 107.79, 107.70, 103.76, 100.61, 36.61.