

An efficient and green synthesis of xanthenes derivatives using CuS quantum dots as heterogeneous and reusable catalyst under solvent free condition

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Supplementary Information

**Table S1: Spectrometric data (¹H and ¹³C NMR) of xanthenes.
Spectroscopic data of entries 4a-4i and 5a-5h of table 2**

Table 2, 4a; ¹H NMR (300 MHz, CDCl₃); δ_H (ppm): 0.97 (6H, s, 2× CH₃), 1.08 (6H, s, 2× CH₃), 2.16-2.18 (4H, d, 2× CH₂), 2.44 (4H, d, 2× CH₂), 4.71 (1H, s, CH), 7.01-7.26 (6H, m).
¹³C NMR (100 MHz, CDCl₃); δ_C (ppm): 27.37, 29.33, 31.82, 32.19, 40.93, 50.75, 115.76, 126.39, 128.04, 128.38, 144.04, 162.01, 195.96

Table 2, 4b; ¹H NMR (300 MHz, CDCl₃); δ_H (ppm): 0.85 (6H, s, 2× CH₃), 1.00 (6H, s, 2× CH₃), 1.97-2.10 (4H, q, 2× CH₂), 2.21-2.37 (4H, q, 2× CH₂), 3.67 (1H, s, OCH₃), 4.70 (1H, s, CH), 6.60-7.26 (4H, m, Ar-H). ¹³C NMR (100 MHz, CDCl₃); δ_C (ppm): 26.89, 29.37, 29.63, 32.10, 41.06, 50.75, 55.11, 110.60, 113.95, 120.48, 127.77, 130.52, 132.21, 157.53, 162.21, 195.45

Table 2, 4c; ¹H NMR (300 MHz, CDCl₃); δ_H (ppm): 0.97 (6H, s, 2× CH₃), 1.08 (6H, s, 2× CH₃), 2.10-2.17 (4H, q, 2× CH₂), 2.40-2.42 (4H, q, 2× CH₂), 3.70 (3H, s, OCH₃), 4.65 (1H, s, CH), 6.69-7.17 (4H, dd, Ar-H). ¹³C NMR (300 MHz, CDCl₃); δ_C (ppm): 27.40, 29.35, 30.96, 32.20, 40.93, 50.78, 55.02, 113.50, 115.90, 129.31, 136.42, 158.03, 161.83, 196.10

Table 2, 4d; ¹H NMR (300 MHz, CDCl₃); δ_H (ppm): 0.98 (6H, s, 2× CH₃), 1.11 (6H, s, 2× CH₃), 2.10-2.24 (4H, q, 2× CH₂), 2.46 (4H, s, 2× CH₂), 4.76 (1H, s, CH), 7.41-8.08 (4H, dd, Ar-H). ¹³C NMR (100 MHz, CDCl₃); δ_C (ppm): 27.41, 29.42, 32.30, 40.99, 50.61, 114.75, 123.44, 129.39, 146.71, 151.23, 162.45, 195.43

Table 2, 4e; ^1H NMR (300 MHz, CDCl_3); δ_{H} (ppm): 0.86 (6H, s, $2\times \text{CH}_3$), 0.99 (6H, s, $2\times \text{CH}_3$), 2.04-2.06 (4H, q, $2\times \text{CH}_2$), 4.59 (1H, s, CH), 7.24-7.39 (4H, m, Ar-H). ^{13}C NMR (100 MHz, CDCl_3); δ_{C} (ppm): 27.43, 29.44, 32.28, 32.52, 41.00, 50.63, 114.84, 129.35, 131.95, 162.37, 195.42.

Table 2, 4f; ^1H NMR (300 MHz, CDCl_3); δ_{H} (ppm): 0.93 (6H, s, $2\times \text{CH}_3$), 1.06 (6H, s, $2\times \text{CH}_3$), 2.10-2.11 (4H, q, $2\times \text{CH}_2$), 2.37 (4H, s, $2\times \text{CH}_2$), 4.57 (1H, s, CH), 7.05-7.08 (2H, d, Ar-H), 7.23-7.26 (2H, d, Ar-H). ^{13}C NMR (100 MHz, CDCl_3); δ_{C} (ppm): 27.50, 29.52, 31.58, 32.27, 41.04, 50.70, 115.45, 120.49, 130.24, 131.22, 143.07, 161.77, 195.10

Table 2, 4g; ^1H NMR (300 MHz, CDCl_3); δ_{H} (ppm): 0.97 (6H, s, $2\times \text{CH}_3$), 1.09 (6H, s, $2\times \text{CH}_3$), 2.13-2.15 (4H, q, $2\times \text{CH}_2$), 2.40-2.41 (4H, s, $2\times \text{CH}_2$), 4.62 (1H, s, CH), 7.13-7.15 (4H, m, Ar-H). ^{13}C NMR (300 MHz, CDCl_3); δ_{C} (ppm): 27.49, 29.53, 31.48, 32.27, 41.04, 50.70, 115.53, 128.29, 129.84, 132.31, 142.54, 161.75, 195.12

Table 2, 4h; ^1H NMR (300 MHz, CDCl_3); δ_{H} (ppm): 1.03 (6H, s, $2\times \text{CH}_3$), 1.13 (6H, s, $2\times \text{CH}_3$), 2.20-2.21 (4H, q, $2\times \text{CH}_2$), 2.47 (4H, q, $2\times \text{CH}_2$), 4.69 (1H, s, CH), 7.09-7.27 (4H, m, Ar-H). ^{13}C NMR (100 MHz, CDCl_3); δ_{C} (ppm): 27.51, 29.41, 31.75, 32.29, 41.00, 50.72, 115.30, 126.80, 127.15, 128.25, 129.24, 134.04, 146.04, 162.08, 195.45

Table 2, 4i; ^1H NMR (300 MHz, CDCl_3); δ_{H} (ppm): 1.04 (6H, s, $2\times \text{CH}_3$), 1.10 (6H, s, $2\times \text{CH}_3$), 2.14-2.15 (4H, d), 2.24 (3H, s, CH_3), 2.29-2.41 (4H, d), 4.62 (1H, s, CH), 6.94-6.97 (2H, d, Ar-H), 7.08-7.10 (2H, d, Ar-H). ^{13}C NMR (100 MHz, CDCl_3); δ_{C} (ppm): 27.55, 29.61, 31.46, 32.30, 41.09, 50.80, 51.12, 116.07, 128.39, 128.86, 135.59, 141.15, 161.37, 163.06, 195.18

Table 2, 5a; ^1H NMR (300 MHz, CDCl_3); δ_{H} (ppm): 6.44 (1H, s, CH), 7.24 (2H, s, Ar-H), 7.37-7.50 (9H, m), 7.74-7.79 (4H, m), 8.33-8.36 (2H, d, Ar-H). ^{13}C NMR (100 MHz, CDCl_3); δ_{C} (ppm): 38.10, 117.39, 118.05, 122.73, 124.22, 126.77, 128.26, 128.54, 128.85, 131.14, 131.58, 145.02, 148.80

Table 2, 5b; ^1H NMR (300 MHz, CDCl_3); δ_{H} (ppm): 2.12 (3H, s, CH_3), 6.39 (1H, s, CH), 6.90-6.93 (2H, d, Ar-H), 7.33-7.38 (4H, m), 7.43-7.46 (2H, d, Ar-H), 7.50-7.53 (2H, d, Ar-H), 7.55-7.78 (4H, m), 8.32-8.35 (2H, d, Ar-H). ^{13}C NMR (100 MHz, CDCl_3); δ_{C} (ppm): 21.02, 37.72, 117.50, 118.03, 122.79, 124.17, 126.71, 128.13, 128.74, 128.82, 129.25, 131.16, 131.59, 135.67, 142.18, 148.72

Table 2, 5c; ; ^1H NMR (300 MHz, CDCl_3); δ_{H} (ppm): 3.54 (3H, s, OCH_3), 6.37 (1H, s, CH), 6.58-6.60 (2H, d, Ar-H), 7.30-7.35 (4H, m), 7.38-7.40 (2H, d, Ar-H), 7.47-7.51 (2H, t, Ar-H), 7.69-7.75 (4H, m), 8.29-8.31 (2H, d, Ar-H). ^{13}C NMR (100 MHz, CDCl_3); δ_{C} (ppm): 37.08, 55.05, 113.84, 117.53, 117.99, 122.67, 124.19, 126.74, 128.70, 128.78, 129.13, 131.07, 131.41, 148.69, 157.84

Table 2, 5d; ^1H NMR (300 MHz, CDCl_3); δ_{H} (ppm): 6.53 (1H, s, CH), 7.34-7.38 (2H, t, Ar-H), 7.42-7.44 (2H, d, Ar-H), 7.50-7.54 (2H, t, Ar-H), 7.59-7.62 (2H, d, Ar-H), 7.75-7.79 (4H, m), 7.91-7.93 (2H, d, Ar-H), 8.19-8.22 (2H, d, Ar-H). ^{13}C NMR (100 MHz, CDCl_3); δ_{C} (ppm): 37.86, 115.78, 118.06, 122.03, 123.86, 124.58, 127.19, 128.96, 129.06, 129.60, 131.09

Table 2, 5e; ^1H NMR (300 MHz, CDCl_3); δ_{H} (ppm): 6.36 (1H, s, CH), 6.85-6.88 (1H, d), 6.95-6.99 (1H, t), 7.30-7.40 (6H, m), 7.47-7.51 (2H, t), 7.69-7.71 (4H, m), 8.21-8.23 (2H, d, Ar-H). ^{13}C NMR (100 MHz, CDCl_3); δ_{C} (ppm): 37.75, 116.58, 118.08, 122.40, 124.38, 126.40, 126.74, 126.96, 128.33, 128.90, 129.16, 129.60, 131.06, 131.27, 134.42, 146.88, 148.79

Table 2, 5f; ^1H NMR (300 MHz, CDCl_3); δ_{H} (ppm): 6.46 (1H, s, CH), 7.08-7.10 (2H, d, Ar-H), 7.39-7.48 (8H, m), 7.78-7.83 (4H, m), 8.29-8.32 (2H, d, Ar-H). ^{13}C NMR (100 MHz, CDCl_3); δ_{C} (ppm): 37.37, 116.76, 118.01, 122.40, 124.36, 126.91, 128.63, 128.90, 129.08, 129.48, 131.08, 131.26, 132.09, 143.45, 148.72

Table 2, 5g; ^1H NMR (300 MHz, CDCl_3); δ_{H} (ppm): 5.21 (1H, s, CH), 7.16-7.18 (2H, d, Ar-H), 7.29-7.40 (6H, m), 7.48-7.52 (2H, t, Ar-H), 7.71-7.76(4H, m), 8.22-8.24 (2H, d, Ar-H). ^{13}C NMR (100 MHz, CDCl_3); δ_{C} (ppm): 37.72, 115.89, 118.12, 121.69, 122.02, 122.71, 124.58, 127.24, 129.06, 129.49, 129.56, 131.04, 131.06, 134.2

Table 2, 5h; ^1H NMR (300 MHz, CDCl_3); δ_{H} (ppm): 6.57 (1H, s, CH), 7.44-7.48 (4H, m), 7.50-7.53 (2H, d, Ar-H), 7.59-7.65 (4H, m), 7.84-7.88 (4H, m), 8.28-8.30 (2H, d, Ar-H). ^{13}C NMR (100 MHz, CDCl_3); δ_{C} (ppm): 26.03, 122.09, 124.65, 127.24, 128.92, 129.21, 129.66, 155.58.