Supplementary Information for

One-Pot, Efficient and Green Synthesis of Acridinedione Derivatives using Highly Monodisperse Platinum Nanoparticles
Supported with Reduced Graphene Oxide

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Materials and Instrumentation

PtCl\textsubscript{4} (99 % Alfa Aesar), tetrahydrofuran (THF) (99.5 %, Merck) and ethanol (99.9 %) were purchased from Merck, 1-octanamine (Sigma Aldrich) were used as received from suppliers. THF was distilled over sodium under argon atmosphere and stored under inert atmosphere. De-ionized water was filtered by Millipore water purification system (18 MΩ) analytical grade. All glassware and Teflon-coated magnetic stir bars were cleaned with aqua regia, followed by washing with distilled water before drying in an oven.

The chemicals used in the synthesis of acridinedione derivatives were obtained from Merck and Aldrich Chemical Company. All chemicals and solvents used for the synthesis were of spectroscopic reagent grade.

Transmission electron microscopy (TEM) images were obtained on a JEOL 200 kV TEM instrument. Sample preparation for TEM analysis involves placement of a drop of 0.5 mg/mL ethanol solution of the prepared catalysts with a carbon support on a carbon covered 400-mesh copper grid; the solvent is then allowed to evaporate. Excess solution was removed with an adsorbent paper and the sample was dried under vacuum at room temperature before analysis. More than 300 particles were calculated to get the integrated information about the overall distribution of Pt-based catalyst sample.

Thermo Scientific spectrometer was used for X-ray Photoelectron Spectroscopy (XPS) measurements and the X-ray source was K\textalpha\ lines of Mg (1253.6 eV, 10 mA). Samples were prepared by depositing the catalyst on Cu double-sided tape (3M Inc.). C 1s line at 284.6 eV was chosen as a reference point and all XPS peaks were fitted using a Gaussian function and the C 1s line at 284.6 eV was used as the reference line.

A Panalytical Empyrian diffractometer with Ultima+theta–theta high resolution goniometer, having an X-ray generator (Cu K\alpha radiation, $k = 1.54056$ Å) and operating condition of 45 kV and 40 mA, were employed in XRD analysis.

Raman spectrum was carried out using an in via Raman microprobe (Renishaw Instruments) with 514 nm laser excitation.

Melting points were measured on a Bibby Scientific Stuart Digital, Advanced, and SMP30. Fourier Transform Infrared (FT–IR) spectra were recorded on Bruker Optics, ALPHA FT–IR spectrometer. The $^1$H-NMR and $^{13}$C-NMR spectra were obtained in DMSO-$d_6$ with Bruker DPX-300 as solvents with tetramethylsilane as the internal reference. The mass analyses were
performed on an Agilent Technologies 6530 Accurate-Mass Q-TOF LC/HRMS at the advanced technology research centre of Dumlupınar University (ILTEM).

**Characterization of Pt NPs@rGO**

**Fig. S1** Low-magnification TEM images of the Pt NPs@rGO

**Fig. S2** XRD of Pt NPs@rGO
Fig. S3. Pt 4f electron spectra of Pt NPs@rGO

Fig. S4. XPS spectra of C 1s for Pt NPs@rGO and GO
Table S1. The effect of molar ratio (Pt/rGO) on model reaction in the presence of Pt NPs@rGO

<table>
<thead>
<tr>
<th>Entry</th>
<th>R</th>
<th>R’</th>
<th>Time(min)</th>
<th>Yield (%)</th>
<th>Pt/rGO</th>
</tr>
</thead>
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<tr>
<td>4a</td>
<td>-H</td>
<td>4-Cl</td>
<td>60</td>
<td>94</td>
<td>1</td>
</tr>
<tr>
<td>4a</td>
<td>-H</td>
<td>4-Cl</td>
<td>60</td>
<td>90</td>
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<td>4-Cl</td>
<td>60</td>
<td>84</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Characterization of acridinedione derivatives

Whereas the infrared (IR) spectra of the novel synthesized 1, 8-dioxoacridine compounds (4i and 4j) aromatic C–H stretching bands are observed between 3056 and 3018 cm$^{-1}$, the aliphatic C–H stretching bands were observed between 2959 and 2955 cm$^{-1}$. The compound 4i of cyan bond was showed at 2223 cm$^{-1}$ and the carbonyl group bonds of compounds 4i and 4j were showed sharp peaks between 1632 and 1634 cm$^{-1}$, respectively.

The $^1$H-NMR spectra of the compounds 4i and 4j belonging to protons of the methyl groups showed singlet peaks between 0.70-0.90 ppm. The methane (-CH$_2$) protons of compounds 4i and 4j were observed in the region between 1.77-2.21 ppm. The signals for the -CH protons of all compounds were observed between 4.95-5.10 ppm and the signals for the aromatic protons were observed in the range between 6.61-7.70 ppm. The hydroxyl (-OH) proton of the compound 4j was showed at 9.05 ppm.

The signals observed in $^{13}$C-NMR (APT) spectrums of all novel acridinedione molecules 4i and 4j are determined to be in line with the recommended molecule structures. Further, when their high resolution mass spectra (HRMS) are examined, the observed molecule ion peaks are in compliance with the recommended structures.
10-(4-Chlorophenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4a)

As yellow crystals, mp. (300-302 °C) [30] (ethanol). $^1$H-NMR (300 MHz, DMSO-d$_6$) $\delta$ (ppm): 0.72 (s, 6H, 2x-CH$_3$), 0.88 (s, 6H, 2x-CH$_3$), 1.78 (d, 2H, $J= 17.43$ Hz, -CH$_2$), 2.00 (d, 2H, $J= 16.00$ Hz, -CH$_2$), 2.16-2.22 (m, 4H, -CH$_2$), 5.05 (s, 1H, -CH), 7.07-7.12 (m, 1H, Ar-H), 7.21-7.32 (m, 4H, Ar-H), 7.48 (d, 2H, $J= 5.44$ Hz, 10.58, Ar-H), 7.68 (d, 2H, $J= 8.84$ Hz, Ar-H); $^{13}$C-NMR (75 MHz, DMSO–d$_6$) $\delta$ (ppm): 26.50, 29.72, 32.33, 32.44, 41.35, 50.03, 113.55, 126.26, 127.97, 128.38, 130.56, 134.37, 137.79, 146.57, 150.58, 195.54; IR (cm$^{-1}$): 3026 w (Ar-H), 2954 s (-CH), 1634 s (C=O), 1590 s (C=C); HRMS (QTOF-ESI): m/z C$_{29}$H$_{30}$ClNO$_2$: 459.1965; found: 460.2061 ([M+H]$^+$).

a)
Fig. S6. a) FT-IR, b) $^1$H NMR, c) $^{13}$C NMR (APT), d) Q-TOF LC/HRMS of 4a
As yellow crystals, mp. (315-317 °C) [31] (ethanol). 1H-NMR (300 MHz, DMSO-d6) δ (ppm): 0.70 (s, 6H, 2x-CH3), 0.90 (s, 6H, 2x-CH3), 1.80 (d, 2H, J= 17.35 Hz, -CH2), 2.01 (d, 2H, J= 16.13 Hz, -CH2), 2.18-2.24 (m, 4H, -CH2), 5.10 (s, 1H, -CH), 7.54-7.60 (m, 4H, Ar-H), 7.70 (d, 2H, J= 8.51 Hz, Ar-H), 8.14 (d, 2H, J= 8.68 Hz, Ar-H); 13C-NMR (75 MHz, DMSO–d6) δ (ppm): 26.57, 29.61, 32.47, 33.35, 41.39, 49.86, 112.51, 119.43, 123.76, 129.43, 134.55, 137.55, 146.16, 151.32, 154.01, 195.53; IR (cm⁻¹): 3054 w (Ar-H), 2958 w (-CH), 1632 s (C=O), 1592 w (C=C); HRMS (QTOF-ESI): m/z calcd. For C29H29ClN2O4: 504.1816; found: 527.1729 ([M+Na]+).
d) Fig. S7. a) FT-IR, b) $^1$H NMR, c) $^{13}$C NMR (APT), d) Q-TOF LC/HRMS of 4b
10-(4-Chlorophenyl)-3,3,6,6-tetramethyl-9-(3-nitrophenyl)-3,4,6,7,9,10 hexahydroacridine-1,8(2H,5H)-dione (4c)

As yellow crystals, mp. (285-287 °C) [32] (ethanol). ¹H-NMR (300 MHz, DMSO-d₆) δ (ppm): 0.72 (s, 6H, 2x-CH₃), 0.88 (s, 6H, 2x-CH₃), 1.82 (d, 2H, J= 17.44 Hz, -CH₂), 2.02 (d, 2H, J= 16.04 Hz, -CH₂), 2.20 (d, 2H, J= 3.30 Hz, -CH₂), 2.25 (d, 2H, J= 4.95 Hz, -CH₂), 5.15 (s, 1H, -CH), 7.51-7.61 (m, 3H, Ar-H), 7.72 (d, 2H, J= 8.79 Hz, Ar-H), 7.78 (d, 1H, J= 7.87 Hz, Ar-H), 7.99-8.03 (m, 1H, Ar-H), 8.12-8.13 (m, 1H, Ar-H); ¹³C-NMR (75 MHz, DMSO-d₆) δ (ppm): 26.47, 29.62, 32.52, 32.92, 41.34, 49.84, 112.72, 121.50, 122.56, 130.21, 130.65, 134.58, 134.75, 137.52, 147.88, 148.60, 151.39, 195.63; IR (cm⁻¹): 3049 w (Ar-H), 2956 w (-CH), 1636 s (C=O), 1576 s (C=C); HRMS (QTOF-ESI): m/z calcd. For C₂₉H₂₉ClN₂O₄: 504.1816; found: 527.1655 ([M+Na]+).

a)
Fig. S8. a) FT-IR, b) $^1$H NMR, c) $^{13}$C NMR (APT), d) Q-TOF LC/HRMS of 4c
As yellow crystals, mp. (304-305 °C) [31] (ethanol). \(^1\)H-NMR (300 MHz, DMSO-\(d_6\)) \(\delta\) (ppm): 0.70 (s, 6H, 2x-CH\(_3\)), 0.90 (s, 6H, 2x-CH\(_3\)), 1.78 (d, 2H, \(J=17.47\) Hz, -CH\(_2\)), 2.01 (d, 2H, \(J=16.05\) Hz, -CH\(_2\)), 2.16-2.19 (m, 4H, -CH\(_2\)), 5.00 (s, 1H, -CH), 7.26 (d, 2H, \(J=8.42\) Hz, Ar-H), 7.42-7.50 (m, 4H, Ar-H), 7.68 (d, 2H, \(J=8.77\) Hz, Ar-H); \(^1^3\)C-NMR (75 MHz, DMSO–\(d_6\)) \(\delta\) (ppm): 26.56, 29.66, 32.27, 32.45, 41.35, 49.96, 113.08, 119.25, 130.33, 130.54, 131.26, 134.44, 137.67, 145.96, 150.81, 195.54; IR (cm\(^{-1}\)): 3062 w (Ar-H), 2956 w (-CH), 1635 s (C=O), 1576 s (C=C); HRMS (QTOF-ESI): m/z calcd. For C\(_{29}\)H\(_{29}\)BrClNO\(_2\): 537.1070; found: 538.1123 ([M+H]+).
Fig. S9. a) FT-IR, b) $^1$H NMR, c) $^{13}$C NMR (APT), d) Q-TOF LC/HRMS of 4d
10-(4-Chlorophenyl)-9-(4-fluorophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8 (2H,5H)-dione (4e)

As yellow crystals, mp. (280-282 °C) [33] (ethanol). $^1$H-NMR (300 MHz, DMSO-$d_6$) δ (ppm): 0.70 (s, 6H, 2x-CH$_3$), 0.90 (s, 6H, 2x-CH$_3$), 1.78 (d, 2H, J= 17.43 Hz, -CH$_2$), 2.01 (d, 2H, J= 16.08 Hz, -CH$_2$), 2.16-2.22 (m, 4H, -CH$_2$), 5.05 (s, 1H, -CH), 7.05 (t, 2H, J= 8.84 Hz, Ar-H), 7.29-7.34 (m, 2H, Ar-H), 7.48 (d, 2H, J= 7.15 Hz, Ar-H), 7.68 (d, 2H, J= 8.70 Hz, Ar-H); $^{13}$C-NMR (75 MHz, DMSO-$d_6$) δ (ppm): 26.52, 29.68, 31.84, 32.45, 41.35, 49.98, 113.42, 114.86, 129.79, 130.53, 134.42, 137.72, 142.80, 150.64, 159.29, 195.55; IR (cm$^{-1}$): 3054 w (Ar–H), 2957 s (-CH), 1637 s (C=O), 1576 s (C=C); HRMS (QTOF-ESI): m/z calcd. For C$_{29}$H$_{29}$ClFNO$_2$: 477.1871; found: 478.1956 ([M+H]$^+$).

a)

![Bruker Spectrum](image)

b)
Fig. S10. a) FT-IR, b) $^1$H NMR, c) $^{13}$C NMR (APT), d) Q-TOF LC/HRMS of 4e
**10-(4-Chlorophenyl)-3,3,6,6-tetramethyl-9-(p-tolyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4f)**

As yellow crystals, mp. (262-265 °C) [32] (ethanol). ¹H-NMR (300 MHz, DMSO-d₆) δ (ppm): 0.75 (s, 6H, 2x-CH₃), 0.80 (s, 6H, 2x-CH₃), 1.76 (d, 2H, J= 17.29 Hz, -CH₂), 1.97-2.22 (m, 9H, -CH₂ and -CH₃), 5.00 (s, 1H, -CH), 7.04 (d, 2H, J= 8.05 Hz, Ar-H), 7.18 (d, 2H, J= 8.00 Hz, Ar-H), 7.35-7.55 (m, 2H, Ar-H), 7.68 (d, 2H, J= 8.82 Hz, Ar-H); ¹³C NMR (75 MHz, DMSO–d₆) δ (ppm): 26.53, 29.15, 31.83, 32.32, 32.43, 41.33, 50.05, 113.69, 127.87, 128.40, 128.96, 134.34, 135.10, 137.83, 143.69, 150.43, 195.54; IR (cm⁻¹): 3050 w (Ar-H), 2952 w (-CH), 1636 s (C=O), 1577 s (C=C); HRMS (QTOF-ESI): m/z calcd. For C₃₀H₃₂ClNO₂: 473.2122; found: 474.2215 ([M+H⁺]).
Fig. S11. a) FT-IR, b) $^1$H NMR, c) $^{13}$C NMR (APT), d) Q-TOF LC/HRMS of 4f
10-(4-Chlorophenyl)-9-(4-methoxyphenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydro acridine-1,8(2H,5H)-dione (4g)

As yellow crystals, mp. (255-257 °C) [34] (ethanol). ¹H-NMR (300 MHz, DMSO-d₆) δ (ppm): 0.75 (s, 6H, 2x-CH₃), 0.85 (s, 6H, 2x-CH₃), 1.76 (d, 2H, J= 17.40 Hz, -CH₂), 1.97-2.22 (m, 6H, -CH₂), 3.70 (s, 1H, -OCH₃), 4.95 (s, 1H, -CH), 6.80 (d, 2H, J= 8.62 Hz, Ar-H), 7.20 (d, 2H, J= 8.61 Hz, Ar-H), 7.40-7.55 (m, 2H, Ar-H), 7.68 (d, 2H, J= 8.78 Hz, Ar-H); ¹³C NMR (75 MHz, DMSO-d₆) δ (ppm): 26.56, 29.73, 31.39, 32.44, 50.07, 55.31, 113.71, 113.83, 128.93, 130.56, 134.34, 137.85, 138.92, 150.28, 157.76, 195.55; IR (cm⁻¹): 3006 w (Ar-H), 2951 w (-CH), 1638 s (C=O), 1577 s (C=C); HRMS (QTOF-ESI): m/z calcd. For C₃₀H₃₂ClNO₃: 489.2071; found: 490.2160 ([M+H]+).

a)

b)
Fig. S12. a) FT-IR, b) $^1$H NMR, c) $^{13}$C NMR (APT), d) Q-TOF LC/HRMS of 4g
**10-(4-Bromophenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4h)**

As yellow crystals, mp. (303-305 °C) [35] (ethanol). $^1$H-NMR (300 MHz, DMSO-$d_6$) δ (ppm): 0.70 (s, 6H, 2x-CH$_3$), 0.90 (s, 6H, 2x-CH$_3$), 1.78 (d, 2H, $J= 17.39$ Hz, -CH$_2$), 2.00 (d, 2H, $J= 16.90$ Hz, -CH$_2$), 2.16-2.23 (m, 4H, -CH$_2$), 5.05 (s, 1H, -CH), 7.07-7.40 (m, 7H, Ar-H), 7.81 (d, 2H, $J= 8.74$ Hz, Ar-H); $^{13}$C-NMR (75 MHz, DMSO–$d_6$) δ (ppm): 26.50, 29.71, 32.32, 32.45, 41.35, 50.03, 113.54, 123.01, 126.27, 127.97, 128.37, 133.54, 138.22, 146.57, 150.51, 195.54; IR (cm$^{-1}$): 3028 s (Ar-H), 2954 s (-CH), 1634 s (C=O), 1575 s (C=C); HRMS (QTOF-ESI): m/z calcd. For C$_{29}$H$_{30}$BrNO$_2$: 503.1460; found: 504.1529 ([M+H]$^+$).

a) [Image of NMR spectrum]

b) [Image of IR spectrum]
Fig. S13. a) FT-IR, b) $^1$H NMR, c) $^{13}$C NMR (APT), d) Q-TOF LC/HRMS of 4h
4-(10-(4-Chlorophenyl)-3,3,6,6-tetramethyl-1,8-dioxo-1,2,3,4,5,6,7,8,9,10-decahydro acridin-9-yl)benzonitrile (4i)

a)

b)
c)
Fig. S14. a) FT-IR, b) $^1$H NMR, c) $^{13}$C NMR (APT), d) Q-TOF LC/HRMS of 4i
10-(4-Chlorophenyl)-9-(4-hydroxyphenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydro acridine-1,8(2H,5H)-dione (4j)

a)

b)
Fig. S15. a) FT-IR, b) $^1$H NMR, c) $^{13}$C NMR (APT), d) Q-TOF LC/HRMS of 4j

**Count vs. Mass-to-Charge (m/z)**

- ESI Scan (0.226 min) Frag=165.0V DA4OH_pos.d
- 476.1997
- 382.1572
- 476.1977