Supplementary Data

Solvent-free Synthesis of Dihydropyridines And acridinediones via a Salicylic Acid Catalyzed Hantzsch Multicomponent Reaction

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Experimental:

1. General remarks

Melting points were determined on an Electrothermal capillary fine control apparatus and are uncorrected. IR spectra were obtained on a Shimadzu FT IR 8201 PC spectrophotometer and only significant absorption band frequencies are cited. ¹H and ¹³C NMR spectra were recorded on a Bruker DPX-250 AVANCE at 250.13 and 62.9 MHz respectively in DMSO-*d*₆. Chemical shifts (δ) are given in part per million downfield from TMS as an internal standard and *J* values in Hz. Elemental analyzes (C, H, N, S) were used to confirm the purity of all compounds and were performed on a CHN Muriel ESCADEILLAS apparatus. The chemicals were used as obtained commercially.

2. Typical experimental procedure for the synthesis of 1,4-dihydropyridines **4a-f** or acridinediones **5a-f**:

A mixture of aldehyde (1mmol), ammonium acetate (4 mmol), ethyl acetoacetate or dimedone (2 mmol) and salicylic acid (20 mol%), was magnetically stirred at 80°C under solvent-free conditions for the appropriate time indicated in Table 2. After complete conversion as indicated by TLC, the reaction mixture was cooled then poured onto crushed ice and the separated solid was filtered. Spectroscopic data for all compounds:

4a: Diethyl 4-(phenyl)-2,6-dimethyl-1,4-dihydropyridine-3,5-dicarboxylate:

Mp 156-158 °C; lit.^[38a] 158-160; ¹H NMR (250 MHz, CDCl₃): δ : 1.25 (t, J = 7.1 Hz, 6H), 2.33 (s, 3H), 2.32 (s, 6H), 4.11 (q, J =7.1 Hz, 4H), 5.01 (s, 1H), 5.97 (s, 1H), 7.11-7.32 (m, 5H); ¹³C NMR (62.9 MHz, CDCl₃): δ : 14.1, 19.5, 39.4, 59.3, 104.1, 127.5, 128.8, 135.7, 144.1, 145.9, 167.8; FT-IR (KBr): 3334, 1690, 1654, 1494, 1243, 1127, 721 cm⁻¹.

4b: Diethyl 4-(4-hydroxyphenyl)-2,6-dimethyl-1,4-dihydropyridine-3,5-dicarboxylate:

Mp 236-238 °C; lit.^[38b] 225-229; ¹H NMR (250 MHz, CDCl₃): δ : 1.25 (t, J =7.1 Hz, 6H), 2.34 (s, 6H), 4.12 (q, J =7.1 Hz, 4H), 5.32 (s, 1H), 5.77 (s, 1H), 7.24-7.41 (m, 4H); ¹³C NMR (62.9 MHz, CDCl₃): δ : 14.1, 19.3, 39.4, 59.8, 103.9, 127.9, 130.9, 130.4, 142.3, 148.5, 167.8; FT-IR (KBr): 3331, 1689, 1656, 1490, 1244, 1126, 720 cm⁻¹.

4c: Diethyl 4-(4-methoxyphenyl)-2,6-dimethyl-1,4-dihydropyridine-3,5-dicarboxylate:

Mp 159-161 °C; lit.^[38a] 161-163; ¹H NMR (250 MHz, CDCl₃): δ: 1.25 (t, *J*=7.2 Hz, 6H), 2.31 (s, 6H), 3.76 (s, 3H), 4.12 (q, *J*=7.2 Hz, 4H), 4.95 (s, 1H), 6.13 (s, 1H), 6.76 (d, *J*=8.6 Hz, 2H), 7.23 (d, *J*=8.6 Hz, 2H). ¹³C NMR (62.9 MHz, CDCl₃): δ: 14.2, 19.4, 38.7, 55.1, 59.7, 104.2, 113.1, 128.9, 140.4, 143.9, 157.8, 167.8; FT-IR (KBr): 3342, 1690, 1651, 1491, 1211, 1124, 750 cm⁻¹

4d: Diethyl 4-(4-bromophenyl)-2,6-dimethyl-1,4-dihydropyridine-3,5-dicarboxylate:

Mp 163-165 °C; lit.^[38c] 162-164; ¹H NMR (250 MHz, CDCl₃): δ: 1.23 (t, *J*=7.1 Hz, 6H), 2.33 (s, 6H), 4.12 (q, *J*=7.1 Hz, 4H), 4.98 (s, 1H), 5.96 (s, 1H), 7.19 (d, *J*=8.4 Hz, 2H), 7.35 (d, *J*=8.4 Hz, 2H); ¹³C NMR (62.9 MHz, CDCl₃): δ: 14.9, 20.1, 39.9, 60.5, 104.3, 120.4, 130.4, 131.5, 144.8, 147.5, 168.1; FT-IR (KBr): 3359, 1697, 1651, 1485, 1251, 1103, 783 cm⁻¹.

4e: Diethyl 4-(styryl)-2,6-dimethyl-1,4-dihydropyridine-3,5-dicarboxylate:

Mp 143-145 °C; lit.^[38b] 148-150; ¹H NMR (250 MHz, CDCl₃): δ : 1.25 (t, J =7.2 Hz, 6H), 2.31 (s, 6H), 3.76 (s, 3H), 4.12 (q, J =7.2 Hz, 4H), 4.95 (s, 1H), 6.13 (s, 1H), 6.76 (d, J =8.6 Hz, 2H), 7.23 (d, J =8.6 Hz, 2H); ¹³C NMR (62.9 MHz, CDCl₃): δ : 14.2, 19.4, 38.7, 55.1, 59.7, 104.2, 113.1, 128.9, 140.4, 143.9, 157.8, 167.8; FT-IR (KBr): 3342, 1690, 1651, 1491, 1211, 1124, 750 cm⁻¹

4f: Diethyl 4-(2-furyl)-2,6-dimethyl-1,4-dihydropyridine-3,5-dicarboxylate:

Mp 163-165 °C; lit.^[38a] 160-162; ¹H NMR (250 MHz, CDCl₃): δ : 1.26 (t, J =7.1 Hz, 6H), 2.31 (s, 6H), 4.17 (q, J =7.1 Hz, 4H), 5.20 (s, 1H), 5.86-5.89 (m, 1H), 6.23-6.25 (m, 1H), 6.37 (s, 1H), 7.21-7.23 (m, 1H); ¹³C NMR (62.9 MHz, CDCl₃): δ : 14.3, 19.4, 33.3, 59.9, 100.4, 104.4, 110.0, 140.8, 145.6, 158.7, 167.5; FT-IR (KBr): 3342, 1697, 1648, 1480, 1361, 1211, 1132, 750 cm⁻¹.

5a: 3,3,6,6-Tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydro-1,8-(2H,5H)-acridinedione:

Mp 286-288 °C; lit.^[39a] 279-280; ¹H NMR (250 MHz, CDCl₃): δ : 0.96 (s, 6H), 1.01 (s, 6H), 2.18 (d, J = 16.2 Hz, 2H), 2.28 (d, J =16.2 Hz, 2H), 2.39 (d, J =16.2 Hz, 2H), 2.42 (d, J = 16.2 Hz, 2H), 4.81

(s, 1H), 7.15-7.23 (m, 5H), 9.37 (s, 1H); ^{13}C NMR (62.9 MHz, CDCl_3): δ : 26.6, 29.3, 32.3, 33.1, 40.6, 50.4, 111.7, 119.6, 127.8, 147.3; FT-IR (KBr): 3435, 3275, 2951, 2885.3, 1624, 1474, 1366, 1227, 1150 cm^{-1} .

5b: 9-(2-Methylphenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydro-1,8-(2H,5H)-acridinedione:

Mp > 300 °C; ^1H NMR (250 MHz, CDCl_3): δ : 1.20 (s, 6H, CH_3), 1.34 (s, 6H), 2.32 (s, 3H), 2.38 (d, $J=16.2$ Hz, 2H), 2.44 (d, $J=16.2$ Hz, 2H), 2.51 (d, $J=16.2$ Hz, 2H), 2.60 (d, $J=16.2$ Hz, 2H), 3.94 (s, 1H), 7.15-7.23 (m, 5H), 9.37 (s, 1H); ^{13}C NMR (62.9 MHz, CDCl_3): δ : 18.3, 26.7, 29.4, 32.3, 39.3, 40.2, 40.4, 50.7, 51.4, 114.3, 125.4, 128.0, 129.4, 135.9, 146.5, 148.7, 195.6; FT-IR (KBr): 3371, 3317, 3193, 2958, 1654, 1608, 1461, 1369, 1211, 1157 cm^{-1} ; Anal. calcd for $\text{C}_{24}\text{H}_{29}\text{NO}_2$: C, 79.30; H, 8.04; N, 3.85; Found: C, 79.45; H, 8.00; N, 3.84.

5c: 9-(4-Methoxyphenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydro-1,8-(2H,5H)-acridinedione:

Mp 270-272 °C; lit.^[39b] 269-270; ^1H NMR (250 MHz, CDCl_3): δ : 0.95 (s, 6H, CH_3), 1.07 (s, 6H, CH_3), 2.15 (d, $J=16.5$ Hz, 2H, CH_2), 2.20 (d, $J=16.5$ Hz, 2H), 2.23 (d, $J=16.5$ Hz, 2H), 2.28 (d, $J=16.5$ Hz, 2H), 3.74 (s, 3H), 5.05 (s, 1H), 6.74 (d, $J=8.7$ Hz, 2H), 7.28 (d, $J=8.7$ Hz, 2H, ArH), 8.58 (s, 1H); ^{13}C NMR (62.9 MHz, CDCl_3): δ : 27.1, 29.4, 31.1, 32.8, 40.8, 50.9, 55.9, 113.2, 113.5, 128.9, 139.4, 149.7, 157.6, 196.4; FT-IR (KBr): 3434, 3275, 3205, 2954, 1648, 1608, 1482, 1365, 1226, 1145 cm^{-1} .

5d: 9-(4-Chlorophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydro-1,8-(2H,5H)-acridinedione:

Mp > 300 °C; lit.^[39a] 296-298; ¹H NMR (250 MHz, CDCl₃): δ: 0.96 (s, 6H), 1.01 (s, 6H), 2.15 (d, *J*=16.4 Hz, 2H), 2.22 (d, *J*=16.4 Hz, 2H), 2.24 (d, *J*= 16.4 Hz, 2H), 2.35 (d, *J*=16.4 Hz, 2H), 5.05 (s, 1H), 6.79 (d, *J*=8.6 Hz, 2H), 7.28 (d, *J*=8.6 Hz, 2H), 8.5 (s, 1H, NH); ¹³C NMR (62.9 MHz, CDCl₃): δ: 27.1, 29.7, 32.7, 33.5, 40.5, 50.9, 112.7, 128.2, 129.6, 131.6, 145.4, 150.0, 196.3; FT-IR (KBr): 3394, 3321, 3205, 3175, 3024, 2198, 1670, 1604, 1469, 1369, 1211, 1149 cm⁻¹.

5e: 9-(4-Dimethylaminophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydro-1,8-(2H,5H)-acridinedione:

Mp 264-266 °C; lit.^[39b] 263-265; ¹H NMR (250 MHz, CDCl₃): δ: 0.96 (s, 6H), 1.06 (s, 6H), 2.21 (m, 8H), 2.83 (s, 6H), 5.01 (s, 1H), 6.59 (d, *J*=8.2 Hz, 2H), 7.21 (d, *J*= 8.2 Hz, 2H), 8.3 (s, 1H); ¹³C NMR (62.9 MHz, CDCl₃): δ: 27.3, 29.7, 32.7, 32.7, 40.5, 40.8, 51.0, 112.5, 113.5, 128.7, 148.6, 149.4, 196.4; FT-IR (KBr): 3433, 3275, 3182, 2954, 1604, 1488, 1361, 1218, 1149 cm⁻¹

5f: 9-(2-Thienyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydro-1,8-(2H,5H)-acridinedione;

Mp > 300 °C; lit.^[39c] 306-308; ¹H NMR (250 MHz, CDCl₃): δ: 1.07 (s, 6H), 1.12 (s, 6H), 2.19 (d, *J*=16.4 Hz, 2H), 2.24 (d, *J*=16.4 Hz, 2H), 2.29 (d, *J*=16.4 Hz, 2H), 2.38 (d, *J*=16.4 Hz, 2H), 5.33 (s, 1H), 6.84-7.02 (m, 3H), 8.6 (s, 1H); ¹³C NMR (62.9 MHz, CDCl₃): δ: 17.6, 26.2, 26.9, 29.7, 31.5, 33.5, 49.9, 56.2, 110.9, 114.5, 121.6, 122.4, 125.4, 148.6, 150.2, 194.1; FT-IR (KBr): 3413, 3274, 3206, 2954, 1635, 1477, 1366, 1218, 1137 cm⁻¹.

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PROCNO 1

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Spectre Carbone : ADAIHO

Current Data Parameters

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PROCNO 1

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d12 0.00000000 sec

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***** CHANNEL f2 *****

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PL13 16.00 dB
SFO2 250.1310000 MHz

F2 - Processing parameters

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SSB 0
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1D NMR plot parameters

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F2P 0.000 ppm
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