



SUPPLEMENTARY MATERIAL TO
**Synthesis of 1,6-hexanediyl-bis(semicarbazides) and
1,6-hexanediyl-bis(1,2,4-triazol-5-ones) and their
antiproliferative and antimicrobial activity**

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ANALYTICAL AND SPECTRAL DATA OF THE SYNTHESIZED COMPOUNDS

Acetic acid, 2,2'-[1,6-hexanediylbis(iminocarbonyl)]dihydrazide (2a). Yield: 78 %; m.p. 270–272 °C; Anal. Calcd. for C₁₂H₂₄N₆O₄ (FW: 316.36): C, 45.55; H, 7.64; N, 26.56 %. Found: C, 45.27; H, 7.58; N, 26.88 %; IR (KBr, cm⁻¹): 3312 (NH), 2937, 1470 (CH aliph.), 1641 (CO); ¹H-NMR (300 MHz, DMSO, δ / ppm): 1.03–1.35 (8H, *m*, CH₂), 1.80 (6H, *s*, CH₃), 2.94–3.07 (4H, *m*, CH₂), 6.31 (2H, *s*, NH), 7.56 (2H, *s*, NH), 9.36 (2H, *s*, NH); ¹³C-NMR (75 MHz, DMSO, δ / ppm): 19.24 (CH₃), 24.63, 28.45 (CH₂), 156.81, 167.80 (CO); MS (*m/z*, (%)): 152 (45), 113 (60), 102 (100), 99 (90), 56(85).

Benzoic acid, 2,2'-[1,6-hexanediylbis(iminocarbonyl)]dihydrazide (2b). Yield: 79 %; m.p. 229–230 °C; Anal. Calcd. for C₂₂H₂₈N₆O₄ (FW: 440.49): C, 59.98; H, 6.40; N, 19.07 %. Found: C, 59.77; H, 6.38; N, 19.32 %; IR (KBr, cm⁻¹): 3304 (NH), 3116 (CH arom.), 2933, 1482 (CH aliph.), 1651 (CO); ¹H-NMR (300 MHz, DMSO, δ / ppm): 1.05–1.38 (8H, *m*, CH₂), 2.93–3.17 (4H, *m*, CH₂), 5.73 (2H, *s*, NH), 6.48 (2H, *s*, NH), 7.35–8.37 (10H, *m*, CH), 10.10 (2H, *s*, NH); ¹³C-NMR (75 MHz, DMSO, δ / ppm): 24.74, 28.51 (CH₂), 126.20, 126.92, 130.27, 131.35 (CH arom.), 157.14 (C Ar), 165.08 (CO); MS (*m/z*, (%)): 284 (15), 143 (100), 98 (50), 86 (45).

1-Methyl-1H-pyrrole-2-acetic acid, 2,2'-[1,6-hexanediylbis(iminocarbonyl)]dihydrazide (2c). Yield: 80 %; m.p. 203–205 °C; Anal. Calcd. for C₂₂H₃₄N₈O₄ (FW: 474.56): C, 55.68; H, 7.22; N, 23.61 %. Found: C, 55.45; H, 7.42; N, 23.78 %; IR (KBr, cm⁻¹): 3349 (NH), 3030 (CH arom.), 2934, 1463 (CH aliph.), 1590

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(CO); ¹H-NMR (300 MHz, DMSO, δ / ppm): 1.22–1.35 (8H, *m*, CH₂), 2.96–2.99 (4H, *m*, CH₂), 3.31 (4H, *s*, CH₂), 3.52 (6H, *s*, CH₃), 5.84 (2H, *s*, NH), 6.23–6.60 (6H, *m*, CH), 7.66 (2H, *s*, NH), 9.55 (2H, *s*, NH); ¹³C-NMR (75 MHz, DMSO, δ / ppm): 22.33 (CH₃), 24.14, 24.35, 24.77, 26.72 (CH₂), 32.05 (CH₂), 104.98, 106.49, 121.06, 123.95 (CH arom), 143.73 (C arom), 153.76 (CO); MS (*m/z*, %): 277 (33), 94 (100).

Formic acid, 2,2'-[1,6-hexanediybis(iminocarbonyl)]dihydrazide (2d). Yield: 77 %; m.p. 155–157 °C; Anal. Calcd. for C₁₀H₂₀N₆O₄ (FW: 288.30): C, 41.65; H, 6.99; N, 29.14 %. Found: C, 41.44; H, 7.03; N, 29.03 %; IR (KBr, cm⁻¹): 3351 (NH), 3032 (CH arom.), 2931, 1465 (CH aliph.) 1589 (CO); ¹H-NMR (300 MHz, DMSO, δ / ppm): 1.06–1.36 (8H, *m*, CH₂), 2.91–3.07 (4H, *m*, CH₂), 7.94 (1H, *s*, CH), 8.01 (1H, *s*, CH), 9.16 (2H, *d*, NH), 9.54 (2H, *d*, NH), 10.05 (2H, *s*, NH); ¹³C-NMR (75 MHz, DMSO, δ / ppm): 24.57, 24.71, 27.79, 28.30 (CH₂), 63.57 (CH), 166.39 (CO).

1-Naphthoic acid, 2,2'-[1,6-hexanediybis(iminocarbonyl)]dihydrazide (2e). Yield: 73 %; m.p. 138–140 °C; Anal. Calcd. for C₃₀H₃₂N₆O₄ (FW: 540.61): C, 66.65; H, 5.96; N, 15.54 %. Found: C, 66.73; H, 5.88; N, 15.34 %; IR (KBr, cm⁻¹): 3353 (NH), 3032 (CH arom.), 2937, 1465 (CH aliph.), 1587 (CO); ¹H-NMR (300 MHz, DMSO, δ / ppm): 1.33–1.56 (8H, *m*, CH₂), 3.32–3.37 (4H, *m*, CH₂), 6.44 (2H, *s*, NH), 7.49–8.06 (15H, *m*, CH), 8.34 (2H, *s*, NH), 10.01 (2H, *s*, NH).

3-Isoquinolinecarboxylic acid, 2,2'-[1,6-hexanediybis(iminocarbonyl)]dihydrazide (2f). Yield: 71 %; m.p. 242–244 °C; Anal. Calcd. for C₂₈H₃₀N₈O₄ (FW: 542.59): C, 61.98; H, 5.57; N, 20.65 %. Found: C, 61.81; H, 5.68; N, 20.46 %. IR (KBr, cm⁻¹): 3347 (NH), 3028 (CH arom.), 2933, 1459 (CH aliph.), 1594 (CO); ¹H-NMR (300 MHz, DMSO, δ / ppm): 1.06–1.57 (8H, *m*, CH₂), 3.32–3.36 (4H, *m*, CH₂), 6.42 (2H, *t*, NH), 7.80–8.57 (14H, *m*, CH), 9.40 (2H, *s*, NH), 10.26 (2H, *s*, NH); ¹³C-NMR (75 MHz, DMSO, δ / ppm): 13.71, 24.70, 27.79, 28.31 (CH₂), 154.54, 156.41, 157.74, 158.80, 159.36, 160.27 (CH arom.), 165.51, 165.64 (C arom.), 166.39 (CO).

Nicotinic acid, 2,2'-[1,6-hexanediybis(iminocarbonyl)]dihydrazide (2g). Yield: 66 %; m.p. 185–187 °C; Anal. Calcd. for C₂₀H₂₆N₈O₄ (FW: 442.47): C, 54.28; H, 5.92; N, 25.32 %. Found: C, 54.12; H, 5.98; N, 25.34 %; IR (KBr, cm⁻¹): 3353 (NH), 3028 (CH arom.), 2931, 1466 (CH aliph.), 1593 (CO); ¹H-NMR (300 MHz, DMSO, δ / ppm): 1.13–1.38 (8H, *m*, CH₂), 2.93–3.02 (4H, *m*, CH₂), 7.47–8.14 (8H, *m*, CH), 7.87 (2H, *s*, NH), 10.29 (4H, *s*, NH).

4,4'-(1,6-Hexanediy)bis[2,4-dihydro-5-methyl-3H-1,2,4-triazol-3-one] (3a). Yield: 89 %; m.p. 235–237 °C.¹⁸

4,4'-(1,6-Hexanediy)bis[2,4-dihydro-5-phenyl-3H-1,2,4-triazol-3-one] (3b). Yield: 70 %; m.p. 238–240 °C.¹⁸

4,4'-(1,6-Hexanediy)bis[2,4-dihydro-5-[(1H-pyrrol-2-yl)methyl]-3H-1,2,4-triazol-3-one] (3c). Yield: 77 %; m.p. 228–230 °C; Calcd. for C₂₂H₃₀N₈O₂ (FW:

438.53); C, 60.25; H, 6.89; N, 25.55 %. Found: C, 60.33; H, 6.78; N, 25.34; IR (KBr, cm^{-1}): 3067 (CH arom.), 2928, 1496 (CH aliph.), 1698 (CO), 1575 (C=N), 1428 (C-N); $^1\text{H-NMR}$ (300 MHz, DMSO, δ / ppm): 1.09–1.26 (8H, *m*, CH_2), 3.39–3.44 (4H, *m*, CH_2), 3.49 (6H, *s*, CH_3), 3.89 (4H, *s*, CH_2), 5.69–6.64 (6H, *m*, CH), 11.44 (2H, *s*, NH); $^{13}\text{C-NMR}$ (75 MHz, DMSO, δ / ppm): 23.70 (CH_3), 25.50, 28.09, 33.41 (CH_2), 106.32, 107.84 (CH arom.), 145.05 (C arom.), 155.09 (CO); MS (*m/z*, (%)): 438 (54) [M^+], 177 (47), 94 (100).

4,4'-(1,6-Hexanediyl)bis[2,4-dihydro-3H-1,2,4-triazol-3-one] (**3d**). Yield: 71 %; m.p. 170–171 °C; Anal. Calcd. for $\text{C}_{10}\text{H}_{16}\text{N}_6\text{O}_4$ (FW: 284.27): C, 42.25; H, 5.67; N, 29.56 %. Found: C, 42.33; H, 5.77; N, 29.48 %; IR (KBr, cm^{-1}): 3072 (CH arom.), 2931, 1489 (CH aliph.), 1708 (CO), 1568 (C=N), 1430 (C-N); $^1\text{H-NMR}$ (300 MHz, DMSO, δ / ppm): 1.03–1.57 (8H, *m*, CH_2), 2.93–3.00 (4H, *m*, CH_2), 7.51 (1H, *s*, CH), 7.88 (1H, *s*, CH), 11.59 (2H, *s*, NH); $^{13}\text{C-NMR}$ (75 MHz, DMSO, δ / ppm): 25.32, 25.59, 28.55 (CH_2), 137.82 (CH), 154.53 (C arom.), 158.90 (CO).

4,4'-(1,6-Hexanediyl)bis[2,4-dihydro-5-(1-naphthyl)-3H-1,2,4-triazol-3-one] (**3e**). Yield: 68 %; m.p. 160–161 °C; Anal. Calcd. for $\text{C}_{30}\text{H}_{28}\text{N}_6\text{O}_2$ (FW: 504.58): C, 71.40; H, 5.59; N, 16.65 %. Found: C, 71.22; H, 5.38; N, 16.73 %; IR (KBr, cm^{-1}): 3067 (CH arom.), 2928, 1496 (CH aliph.), 1698 (CO), 1575 (C=N), 1428 (C-N); $^1\text{H-NMR}$ (300 MHz, DMSO, δ / ppm): 0.89–1.57 (8H, *m*, CH_2), 2.72–3.39 (4H, *m*, CH_2), 7.31–8.35 (14H, *m*, CH), 10.01 (1H, *s*, NH), 12.05 (1H, *s*, NH); $^{13}\text{C-NMR}$ (75 MHz, DMSO, δ / ppm): 25.28, 25.49, 25.85, 26.11, 26.18, 28.02 (CH_2), 124.5–132.7 (CH), 133.1, 133.5, 145.3, 155.2 (C arom.), 168.7 (CO); MS (*m/z*, (%)): 212 (75), 155 (100), 127 (80).

4,4'-(1,6-Hexanediyl)bis[2,4-dihydro-5-(1-isoquinolyl)-3H-1,2,4-triazol-3-one] (**3f**). Yield: 67 %; m.p. 150–152 °C; Anal. Calcd. for $\text{C}_{28}\text{H}_{26}\text{N}_8\text{O}_2$ (FW: 506.56): C, 66.38; H, 5.17; N, 22.12 %. Found: C, 66.24; H, 5.07; N, 22.34 %; IR (KBr, cm^{-1}): 3068 (CH arom.), 2929, 1702 (CH aliph.), 1573 (CO), 1495 (C=N), 1427 (C-N); $^1\text{H-NMR}$ (300 MHz, DMSO, δ / ppm): 1.11–1.58 (8H, *m*, CH_2), 3.89–4.11 (4H, *m*, CH_2), 7.48–8.69 (14H, *m*, CH), 12.12 (2H, *s*, NH); MS (*m/z*, (%)): 189 (22), 163 (39), 137 (100), 78 (57).

4,4'-(1,6-Hexanediyl)bis[2,4-dihydro-5-(1-pyridinyl)-3H-1,2,4-triazol-3-one] (**3g**). Yield: 66 %; m.p. 125–126 °C; Anal. Calcd. for $\text{C}_{20}\text{H}_{22}\text{N}_8\text{O}_2$ (FW: 406.44): C, 59.10; H, 5.45; N, 27.56 %. Found: C, 59.32; H, 5.33; N, 27.43 %; $^1\text{H-NMR}$ (300 MHz, DMSO, δ / ppm): 1.08–1.41 (8H, *m*, CH_2), 3.59–3.71 (4H, *m*, CH_2), 7.53–68.84 (8H, *m*, CH), 11.80 (2H, *s*, NH); $^{13}\text{C-NMR}$ (75 MHz, DMSO, δ / ppm): 23.72, 24.15, 24.29, 24.76, 26.73 (CH_2), 122.02, 122.49, 133.87, 134.07, 142.72, 142.77 (CH arom.), 146.89, 149.55 (C arom.), 156.84, 163.42 (CO); MS (*m/z*, (%)): 406 (23) [M^+], 231 (65), 189 (67), 163 (100), 105 (65).