Synthesis of 1,5-diisopropyl substituted 6-oxoverdazyls.

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Supplementary Material

2.4-Diisopropyl-6-(methylpyridin-2-yl)-1,2,4,5-tetrazinan-3-one (7b)

6-Methylpyridine-2-carboxaldehyde (2 mmol) gave 551 mg (99%) of the corresponding tetrazane with m.p. 151-154 ºC; (calcd for C13H11NO: C 65.29 H 7.34 N 22.17; found: C 64.65 H 7.33 N 22.03; δmax(NaCl plate)/cm⁻¹ 3232 (N-H) 3060 (C-H), 2970 (C-H), 2932 (C-H), 1619 (C=O); δ_H (300 MHz, CDCl₃) 1.22 (6H, d, J = 6.6), 1.15 (6H, d, J = 6.6), 4.56 (3H, br s), 4.70 (2H, septet, J = 6.6), 7.50 (1H, d, J = 8.4), 7.56 (1H, t, J = 8.8), 7.74 (1H, t, J = 8.4), 7.84 (1H, d, J = 8.0), 8.06 (1H, t, J = 8.1) 8.21 (1H, d, J = 8.4); δ_C (75MHz, CDCl₃) 18.6, 19.6, 47.8, 71.5, 121.3, 127.2, 127.9, 129.3, 130.2, 137.5, 153.7, 153.9, 154.7; MS (electrospray) 314 (MH⁺, 100%); HPLC under the conditions for 8a above eluted the product at 7.8 min (96% pure by integration).

1.5-Diisopropyl-3-(quinolin-2-yl)-6-oxoverdazyl (8c)

Quinolin-2-carboxaldehyde (0.5 mmol) gave 84 mg (54%) of the corresponding tetrazane with m.p. 148-150 ºC (EtOH/H₂O); (found: C 64.56 H 7.33 N 21.99; calcd for C₁₀H₇NO: C 64.23 H 7.45 N 22.03); δmax(NaCl plate)/cm⁻¹ 3232 (N-H) 3006 (C-H), 2970 (C-H), 2932 (C-H), 1619 (C=O); δ_H (300 MHz, CDCl₃) 1.12 (6H, d, J = 6.6), 1.15 (6H, d, J = 6.6), 4.56 (3H, br s), 4.70 (2H, septet, J = 6.6), 7.50 (1H, d, J = 8.4), 7.56 (1H, t, J = 8.8), 7.74 (1H, t, J = 8.4), 7.84 (1H, d, J = 8.0), 8.06 (1H, t, J = 8.1) 8.21 (1H, d, J = 8.4); δ_C (75MHz, CDCl₃) 18.6, 19.6, 47.8, 71.5, 121.3, 127.2, 127.9, 129.3, 130.2, 137.5, 147.6, 153.9, 154.7; MS (electrospray) 314 (MH⁺, 100%)

1.5-Diisopropyl-3-(imidazol-2-yl)-6-oxoverdazyl (8d)

Oxidation of 252 mg (1mmol) of 2.4-diisopropyl-6-imidazol-2-yl-1,2,4,5-tetrazinan-3-one with 164 mg (1.5 mmol) benzoquinone in 5 mL toluene gave a sticky red residue. Chromatography on silica gel eluting with 1:9 CH₂Cl₂/MeOH gave the verdazyl as a red crystalline solid (142 mg, 56%) with m.p. 192-195 ºC (dec); UV-vis (MeCN) 420, 500 nm; δmax(NaCl plate)/cm⁻¹ 3295 (C-H), 1683 (C=O); MS (electrospray) 250 (MH⁺, 100%); HPLC under the conditions for 8a above eluted the product at 5.1 min (99% pure by integration).
1.5-Diisopropyl-3-(4-hydroxyphenyl)-6-oxoverdazyl (8e)
Oxidation of 55 mg (0.2 mmol) of 6-(4-hydroxyphenyl)-2,4-diisopropyl-1,2,4,5-tetrazinan-3-one with 1.5 mol eq. benzoquinone in 2 mL toluene gave a red solid. Chromatography on silica gel eluting with CH₂Cl₂ followed by recrystallization from dichloromethane/heptane gave the verdazyl as a red crystalline solid (39 mg, 70%) with m.p. 188-190°C; UV-vis (MeCN) 420, 520, 550(sh); ν_max(NaCl plate)/cm⁻¹ 3312 (OH) 2924 (C-H), 1654 (C=O); MS (electrospray, negative ion mode) 274(M-H, 100%); HPLC under the conditions for 8a above eluted the product at 12.8 min (97% pure by integration).

2.4-Diisopropyl-6-(2-Hydroxyphenyl)-1,2,4,5-tetrazinan-3-one (7f)
Salicylaldehyde (0.5 mmol) gave 98mg (71%) of the corresponding tetrazane with m.p. 200-203°C (dec); (Found: C 60.15 H 7.93 N 20.03. Caled for C₁₆H₁₂N₂O₂: C 60.41 H 7.97 N 20.13). ν_max(NaCl plate)/cm⁻¹ 3225 (N-H), 2977 (C-H) 1611 (C=N) 1561 (C=O); δH (300 MHz, dmsr-d6) 1.00 (6H, d, J=6.6), 1.01 (6H, d, J=6.6), 0.50 (3H, m), 4.99 (2H, d, J=11.28, exchanges with D₂O), 6.81 (td, 1H, J=7.5, 0.8), 6.86 (dd, 1H, J=7.5, 0.8). 7.17 (dd 1H, J=7.5, 1.4), 7.37 (dd, J=7.5, 1.4), 9.78 (bs, 1H, exchanges with D₂O); δC (75 MHz, dmsr-d6) 18.8, 20.0, 47.5, 68.2, 116.1, 119.6, 123.2, 127.6, 129.8, 154.0, 155.3; MS (electrospray) 279 (MH⁻, 100%)

1.5-Diisopropyl-3-(2-Hydroxyphenyl)-6-oxoverdazyl (8f)
2,4-Diisopropyl-6-(2-hydroxyphenyl)-1,2,4,5-tetrazinan-3-one (30 mg) was refluxed with 1.5 mol eq. benzoquinone in 5 mL toluene and the resulting solution filtered and evaporated. Chromatography of the residue on silica gel eluting with CH₂Cl₂ gave the verdazyl as a fuschia crystalline solid (22 mg, 73%) m.p. 200-203°C; UV-vis (MeCN) 422, 523, 560 nm. ν_max(NaCl plate)/cm⁻¹ 3158 (OH) 2978, 2929 (C-H), 1683 (C=O); MS (electrospray, solution in 0.1 N NaOH, negative ion mode) 571 (26%, M⁻₂Na⁻), 275(100, M⁻); HPLC under the conditions for 8a above eluted the product at 12.3 min (97% pure by integration).

2.4-Diisopropyl-6-(4'-biphenyl)-1,2,4,5-tetrazinan-3-one (7g)
Biphenyl-4-carboxaldehyde (0.5 mmol) gave 60 mg (36 %) of the corresponding tetrazane. Recrystallization from heptane gave a white solid with m.p. 199-200°C; (Found: C 70.58, H 16.55. Caled for C₁₂H₉N₂O₂: C 70.98 H 16.24). ν_max(NaCl plate)/cm⁻¹ 3228 (N-H), 3054, 3031, 2970, 2933 (C-H), 2920 (C-H) 1701 (C=O), 1599 (C=C); δH (300 MHz, CDCl₃) δ 1.17 (6H, d, J=6.6), 1.18 (6H, d, J=6.6). 3.77 (2H, d, J=11.5, NH) 4.66 (1H, t, J=11.5), 4.72 (2H, septet, J=6.6) 7.36 (1H, m), 7.46 (2H, m), 7.59 (2H, m), 7.64 (4H, m); δC (75 MHz, CDCl₃) 18.5, 19.7, 47.9, 71.0, 126.7, 127.2, 127.5, 127.8, 129.0, 134.6, 140.5, 141.9, 154.4; MS (electrospray) 339 (MH⁻, 100%)

1.5-Diisopropyl-3-(4'-biphenyl)-6-oxoverdazyl (8g)
Oxidation of 36 mg (0.1mmol) of 2,4-diisopropyl-6-(4'-biphenyl)-1,2,4,5-tetrazinan-3-one with 15 mg (0.15 mmol) benzoquinone in 3 mL refluxing toluene for 1h gave an orange red solution that was evaporated to give a red solid. Chromatography on silica gel eluting with CH₂Cl₂ followed by recrystallization from dichloromethane/heptane gave the verdazyl as a red crystalline solid (23 mg, 64%) with m.p. 175-176°C; UV-vis (MeCN) 420, 500 nm, ν_max(NaCl plate)/cm⁻¹ 2974, 2926 (C-H), 1665 (C=O); MS (electrospray) 336 (MH⁻, 100%); HPLC 150 mm C18 reverse phase column, eluting isocratically for 2 min with 70% acetonitrile/30% 0.1 M aqueous ammonium acetate (pH 6.95) followed by a gradient to 100% acetonitrile over 7.5 min and isocratic elution thereafter. Product elutes at 11.5 min (98% pure).