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FIRST EXAMPLE OF SYNTHESIS OF THIENO[2,3-*d*]PYRIMIDINE-6-CARBALDEHYDES BY OXIDATION OF THIENO[2,3-*d*]PYRIMIDIN-6-YL METHANOLS WITH MOLECULAR IODINE

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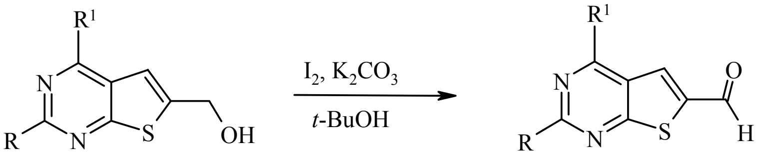
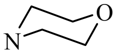
Currently some interest has been attracted by oxidizing systems based on molecular iodine, as a readily available, mild, and environmentally friendly oxidizing agent that is less toxic than other halogens or chromium compounds. Aldehyde synthesis by oxidation of primary alcohols with molecular iodine can be accomplished photochemically [1], with microwave irradiation [2], or in the presence of TEMPO as a catalyst [3]. Recently in [4] it was shown that oxidation of some primary alcohols by excess molecular iodine in 2,2,2-trifluoroethanol in the presence of K_2CO_3 occurs *via* aldehydes, and the corresponding 2,2,2-trifluoroethyl carboxylic acid esters are formed. While we were continuing research on synthesis of derivatives of condensed pyrimidine heterocycles [5-7] in a study of synthesis routes for potential defoliants in the thienopyrimidine series, the need arose to obtain some thieno[2,3-*d*]pyrimidine-6-carbaldehydes. We carried out oxidation of the readily available thieno[2,3-*d*]pyrimidin-6-yl methanols **1a,b** by excess molecular iodine and K_2CO_3 in *tert*-butyl alcohol. Aldehydes **2a,b** were isolated in 54% and 71% yields respectively after prolonged heating (40 h and 36 h) of the reaction mixture at a temperature of 50°C.



1a,b **2a,b**

1, **2** **a** R = NH_2, R^1 = OMe, **b** R = SMe, R^1 = 

Since the oxidizing system $I_2/K_2CO_3/t$-BuOH does not involve NH_2 and SMe groups that are sensitive to oxidizing agents, we can hope that this synthesis method will be useful for synthesis of other classes of aldehydes also. The results of a more detailed investigation to determine the scope of application for this aldehyde synthesis method will be reported in a separate paper.

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The IR spectra were taken on a Perkin–Elmer Spectrum BX II FT-IR spectrophotometer in vaseline oil. The ^1H and ^{13}C NMR spectra were obtained on a Varian INOVA spectrometer (300 MHz and 75 MHz respectively) in DMSO-d_6, internal standard TMS. The course of the reactions and the purity of the compounds obtained were monitored by TLC on Alugram Sil G/UV-254 plates (Macherey-Nagel).

Thieno[2,3-*d*]pyrimidine-6-carbaldehydes 2a,b. A mixture of compound **1a** or **1b** (1 mmol) [7], K_2CO_3 (0.35 g, 2.5 mmol), iodine (0.64 g, 2.5 mmol), and *tert*-butyl alcohol (15 ml) was stirred at a temperature of 50°C under an argon atmosphere until the starting compound disappeared (monitored by TLC). After cooling down to room temperature, the reaction mixture was poured into a 7.9 M $Na_2S_2O_3$ solution (50 ml) and acidified with 5% hydrochloric acid to pH 6.5. The precipitate was filtered and then washed with water (2 × 5 ml) and 2-propanol (2 × 3 ml), and then recrystallized. Compounds **2a,b** were obtained.

2-Amino-4-methoxythieno[2,3-*d*]pyrimidine-6-carbaldehyde (2a). Reaction time 40 h. Yield 54%; mp 204-207°C (dioxane). IR spectrum, ν, cm^{-1}: 3314, 3172 (NH_2), 1654 (CHO). ^1H NMR spectrum, δ, ppm: 4.01 (3H, s, OCH_3); 7.42 (1H, br. s, NH_2); 8.13 (1H, s, H-5); 9.86 (1H, s, CHO). ^{13}C NMR spectrum, δ, ppm: 54.6, 111.3, 132.8, 133.3, 163.3, 166.5, 174.1, 185.4. Found, %: C 45.77; H 3.47; N 19.81. $C_8H_7N_3O_2S$. Calculated, %: C 45.92; H 3.37; N 20.08.

2-Methylthio-4-morpholinothieno[2,3-*d*]pyrimidine-6-carbaldehyde (2b). Reaction time 36 h. Yield 71%; mp 214-216°C (2-PrOH). IR spectrum, ν, cm^{-1}: 1658 (CHO). ^1H NMR spectrum, δ, ppm (*J*, Hz): 2.51 (3H, s, SCH_3); 3.78 (4H, t, $J = 9.8$, $2NCH_2$); 3.97 (4H, t, $J = 9.8$, $2OCH_2$); 8.62 (1H, s, H-5); 9.96 (1H, s, CHO). ^{13}C NMR spectrum, δ, ppm: 14.4, 47.02, 66.5, 113.1, 134.8, 136.04, 158.2, 169.9, 172.8, 185.9. Found, %: C 48.97; H 4.44; N 14.02. $C_{12}H_{13}N_3O_2S_2$. Calculated, %: C 48.79; H 4.44; N 14.23.

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