Chemistry of Heterocyclic Compounds, Vol. 41, No. 5, 2005

CONDENSATION OF SULFUR CONTAINING PYRIDINE SYSTEMS. 2*. SYNTHESIS AND METHYLATION OF TRIETHYLAMMONIUM 1-CYANO-4,5-DIOXO-3,4,5,6-TETRAHYDRO[1]BENZOPYRANO[3,4-*c*]PYRIDINE-2-THIOLATE

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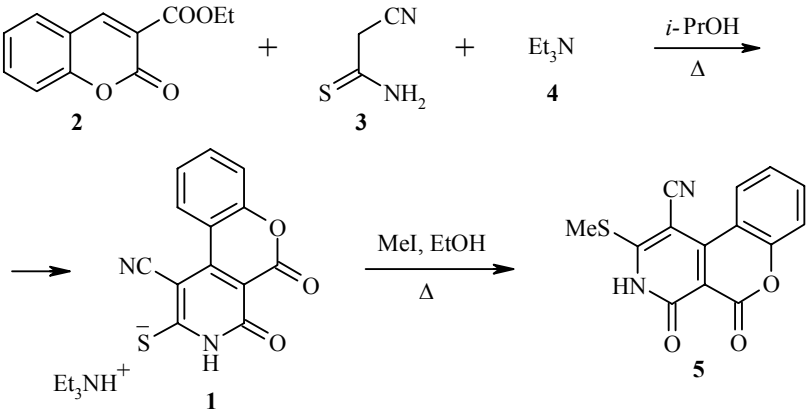
Treatment of 3-carbethoxycoumarin with cyanothioacetamide in refluxing i-PrOH in the presence of excess Et_3N gave the previously unknown triethylammonium 1-cyano-4,5-dioxo-3,4,5,6-tetrahydro[1]benzopyrano[3,4-c]pyridine-2-thiolate. Its methylation has been studied and occurs regioselectively to give the corresponding S-methylation product.

Keywords: [1]benzopyrano[3,4-*c*]pyridinethiolate, cyanothioacetamide, 3-carbethoxycoumarin, methylation.

Different coumarins with functional substituents in position 3 have been successfully used in the synthesis of benzopyrano[3,4-c]pyridine derivatives [2-8]. Bearing in mind the available data for the antibacterial [2] and antipsychotic [9] activity and different practical use of similar compounds [10] we have developed a method for the preparation of the previously unknown ammonium [1]benzopyrano[3,4-c]pyridine thiolate (**1**) and have studied its methylation. Hence refluxing an equimolar mixture of 3-carbethoxycoumarin (**2**) and cyanothioacetamide (**3**) with triethylamine (1.5 equivalents) in *i*-PrOH gave the thiolate **1** in 46% yield. When the reaction was carried out in EtOH the yield of the product **1** was lowered to 28.5%.



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When the triethylamine was exchanged for N-methylmorpholine and EtOH was used as solvent the thiolate **1** was formed but the yield of the latter was only 9%. The methylation of the salt **1** with an excess of MeI in EtOH occurs regioselectively at the sulphur atom to give the pyridocoumarin **5** in 52.3% yield The obtained compounds **1** and **5** probably exist in the lactam tautomeric form and this is partially confirmed from their IR and ^{1}H NMR spectroscopic data and also by many literature analogs [1].

EXPERIMENTAL

^{1}H NMR spectra (200 MHz) were recorded on a Gemini 200 instrument using DMSO-d_6 solvent and IR spectra on an IRS-29 spectrophotometer using vaseline oil. Monitoring of the reaction course and purity of the products obtained was carried out using TLC on Silufol UV-254 plates with acetone–hexane (3:5) eluent and were revealed using iodine vapor.

Triethylammonium 1-Cyano-4,5-dioxo-3,4,5,6-tetrahydro[1]benzopyrano[3,4-*c*]pyridine-2-thiolate (1). Triethylamine (2 ml, 15 mmol) was added to a suspension of the coumarin **2** (2.18 g, 10 mmol) and cyanothioacetamide **3** (1 g, 10 mmol) in *i*-PrOH (20 ml). The mixture obtained was refluxed for 9 h using a reflux condenser, cooled to 20°C, and held at this temperature for 24 h. The precipitated thiolate **1** was filtered off and successively washed with EtOH and Me_2CO. Yield 46% of yellow crystals; mp 198-200°C. IR spectrum, ν, cm^{-1}: 3500, 3430, 3170 (NH, NH$^+$); 2209 (CN); 1720, 1710 (C=O). ^{1}H NMR spectrum, δ, ppm (*J*, Hz): 1.22 (9H, t, *J* = 7.2, $\underline{CH_3}CH_2$); 3.16 (6H, q, *J* = 7.2, $CH_3\underline{CH_2}$); 7.23, 7.56, and 9.05 (4H, three m, H_{arom}); 11.31 (1H, s, NH). The NH$^+$ signal was not observed, probably because of deuterium exchange. Found, %: C 61.79; H 5.77; N 11.36. $C_{19}H_{21}N_3O_3S$. Calculated, %: C 61.44; H 5.70; N 11.31.

1-Cyano-2-methylthio-4,5-dioxo-3,4,5,6-tetrahydro[1]benzopyrano[3,4-*c*]pyridine (5). A suspension of the thiolate **1** (1 g, 2.7 mmol) in EtOH (90%, 15 ml) was taken to reflux and the solution obtained was added through a fluted filter to a solution of MeI (0.5 ml, 8 mmol) in EtOH (5 ml). The reaction mixture was stirred for 0.5 h at 50°C and then at 20°C for 24 h. The precipitated compound **5** was filtered off and washed with EtOH and hexane. Yield 52.3% as light yellow crystals; mp 276-277°C. IR spectrum, ν, cm^{-1}: 3210 (NH); 2214 (CN); 1700, 1680 (C=O), ^{1}H NMR spectrum, δ, ppm (*J*, Hz): 2.66 (3H, s, SCH_3); 7.51, 7.80, and 8.96 (4H, three m, H_{arom}). The NH group signal was not observed, probably because of deuterium exchange. Found, %: C 58.99; H 2.90; N 9.93. $C_{14}H_8N_2O_3S$. Calculated, %: C 59.15; H 2.84; N 9.85.

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