# Synthesis of 5*H*-5-Oxobenzimidazo[2,1-*b*]pyrido[3,2-*e*][1,3]thiazine, A Novel Ring System



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Reaction between 2-chloronicotinic acid chloride and 2-mercaptobenzimidazole afforded 5*H*-5-oxobenzimidazo[2,1-*b*]pyrido[3,2-*e*][1,3]thiazine, a novel heterocyclic ring system. The assigned structure was confirmed by means of mass spectrometry.

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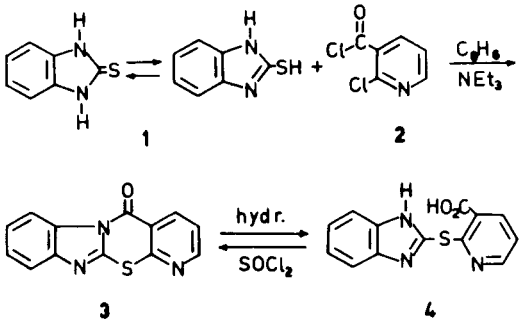
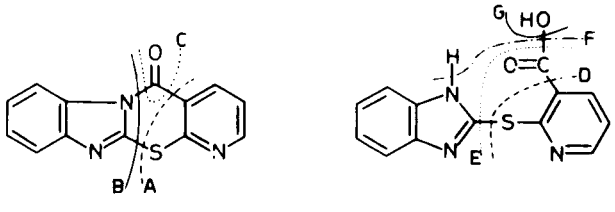
As well known 2-mercaptobenzimidazole is a typical ambident nucleophilic compound [1], we therefore decided to investigate its behavior toward an ambident electrophilic reagent. As the ambident electrophilic reagent we chose 2-chloronicotinic acid chloride in which both the chlorine atoms are readily replaceable. This reaction occurred very easily, under mild conditions, affording the title compound in high yield (Scheme 1 below).

Scheme 1



Evidence for the assigned structure was provided by mass spectra of **3** and **4**. In fact, both the spectra show the ion $[PyS]^+$ which confirms the presence of a sulfur bridge between the position 2 of the benzimidazole ring and the analogous position of the pyridine nucleus.

Scheme 2



Fragmentation Pathways of **3** and **4**

Ring formation increases the stability of the N-CO bond towards hydrolysis. On treatment of **3** with 2*N* sodium hydroxide, at room temperature for 6 hours, 20% of the starting product was recovered unchanged, whereas 1-acylbenzimidazoles are readily hydrolyzed [2]. On treatment with boiling 2*N* sodium hydroxide, followed by acidification, **3** was converted into the carboxylic acid **4**. A quantitative reconversion of **4** into **3** was accomplished by treating **4** with thionyl chloride in dry benzene.

## EXPERIMENTAL

Melting points are uncorrected. The ir spectra were measured with a Perkin-Elmer 283 spectrophotometer from potassium bromide discs. The mass spectra were recorded with a Kratos MS 80 instrument at 50 eV.

5*H*-5-Oxobenzimidazo[2,1-*b*]pyrido[3,2-*e*][1,3]thiazine (**3**).

A solution of dry triethylamine (4.7 g, 46 mmoles) in dry benzene (10 ml) was added slowly to a well-stirred suspension of 2-mercaptobenzimidazole (3.4 g, 23 mmoles) and 2-chloronicotinic acid chloride (4.1 g, 23 mmoles) in dry benzene (30 ml) and the resulting mixture was allowed to react for 4 hours. Removal of the solvent left a residue which was treated with water and filtered. The solid was washed with a cold, dilute solution of sodium hydroxide, then with water, and dried, which amounted to 5.12 g (88% yield) of **3**, mp 195° from ethanol; ir: 1690 $cm^{-1}$; ms: m/e 253 ($M^+$), 225 ($M^+ - CO$), 137 ($PySCO^+$), 109 ($PyS^+$).

*Anal.* Calcd. for $C_{13}H_7N_3OS$: C, 61.65; H, 2.78; N, 16.59. Found: C, 61.58; H, 2.70; N, 16.50.

2-(Benzimidazol-2-ylthio)nicotinic Acid (**4**).

A suspension of **3** (2 g, 8 mmoles) in 2*N* sodium hydroxide (10 ml) was refluxed until a clear solution resulted. This solution was cooled and acidified with dilute hydrochloric acid until the *p*H was 4. The solid product that separated out was collected, washed with water and dried, which amounted to 2.1 g (97% yield) of **4**, mp 219-220° dec from water; ir: 1690 $cm^{-1}$; ms: m/e 271 ($M^+$), 253 ($M^+ - H_2O$), 226 ($M^+ - CO_2H$), 137 ($PySCO^+$), 109 ($PyS^+$).

*Anal.* Calcd. for $C_{13}H_9N_3O_2S$: C, 57.55; H, 3.34; N, 15.49. Found: C, 57.38; H, 3.43; N, 15.56.

## REFERENCES AND NOTES

[1] P. N. Preston, D. M. Smith and G. Tennant, in "The Chemistry of Heterocyclic Compounds", Vol 40, Part 1, P. N. Preston, ed, John Wiley and Sons, Inc., New York, NY, 1981, p 360.

[2] K. Hofmann, in "The Chemistry of Heterocyclic Compounds", Vol 6, Part 1, A. Weissberger, ed, Interscience Publishers, Inc., New York, NY, 1953, p 273.