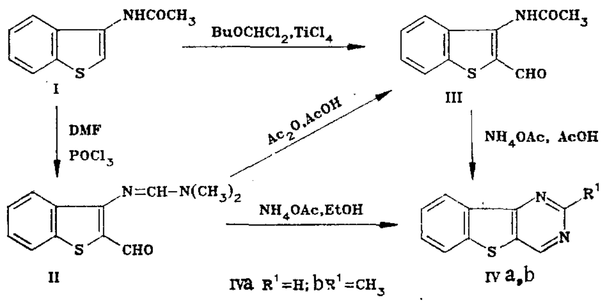
FORMYLATION OF 3-ACETAMIDOBENZO[b]THIOPHENE AND PREPARATION OF BENZOTHIENO[3,2-d]PYRIMIDINES

A. Ya. Bushkov, O. I. Lantsova, V. A. Bren',
and V. I. Minkin

UDC 547.735'853.3.07

No information regarding 3-acetamidobenzo[b]thiophene-2-carbaldehyde and its derivatives is available in the literature, whereas the study of these compounds is of interest from the point of view of the preparation of condensed heterocyclic structures, as well as potentially tautomeric and ligand systems.

We have shown that the reaction of 3-acetamidobenzo[b]thiophene (I) with the Vilsmeier reagent under conditions similar to those in the formylation of 3-acetamidothiophene [1] gives N-(2-formylbenzo[b]thiene-3-yl)-N',N'-dimethylformamidine (II, 35% yield) rather than the expected aldehyde III.



Aldehyde III is formed from amidine II in 50% by careful heating of the latter in an excess amount of AcOH (98%)–Ac_2O (10:1). The direct I → III transformation can be accomplished in 15% yield by formylation of benzothiophene I by the method in [2].

Aldehydes II and III are convenient key compounds for the construction of the virtually uninvestigated benzothieno[3,2-d]pyrimidine system. Benzothieno[3,2-d]pyrimidines IVa-b (in 75-80% yields) were synthesized from II and III by known methods for the formation of a pyrimidine ring [3, 4]. The method that we have proposed for the preparation of pyrimidine IVa differs from the previously described method [5] with respect to the simplicity of the operations and the accessibility of the starting compound.

We obtained II [mp 113°C (from hexane); IR spectrum: 1620 (C═N) and 1650 cm^{-1} (C═O); PMR spectrum (CCl_4); 3.11 and 3.15 (6H, d, NMe_2), 7.17-7.97 (5H, m, C_6H_4 and CH═N), and 9.73 ppm (1H, s, CHO)], III [mp 208°C (from chloroform); IR spectrum: 3225 (NH), 1695 (C═O), and 1640 cm^{-1} (CONH)], IVa [mp 144°C (from hexane) [5]; PMR spectrum (CCl_4): 7.41-7.91 (3H, m, 6-, 7-, 8-H), 8.52 (1H, m, 9-H), and 9.17 ppm (2H, broad s, 2- and 4-H)], and IVb [mp 124°C (from hexane); PMR spectrum (CCl_4): 2.87 (3H, s, CH_3), 7.55-8.05 (3H, m, 6-, 7-, and 8-H), 8.51 (1H, m, 9-H), and 9.10 ppm (1H, s, 4-H)].

The results of elementary analysis and the molecular masses (by mass spectrometry) of the synthesized substances were in agreement with the calculated values.

LITERATURE CITED

1. G. Ah-Kow, C. Paulmier, and P. Pastour, Bull. Soc. Chim. France, Nos. 1-2, 151 (1976).
2. H. Gross, A. Rieche, and G. Matthey, Chem. Ber., 96, 308 (1963).

M. A. Suslov Rostov State University. Scientific-Research Institute of Physical and Organic Chemistry, M. A. Suslov Rostov State University, Rostov-on-Don 344771. Translated from Khimiya Geterotsiklicheskikh Soedinenii, No. 4, pp. 565-566, April, 1985. Original article submitted October 29, 1984.

0009-3122/85/2104-0476$09.50

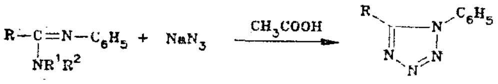
3. N. N. Suvorov, V. A. Chernov, V. S. Velezheva, Yu. A. Ershova, S. V. Simakov, and V. P. Sevodin, Khim.-farm. Zh., No. 9, 27 (1981).
4. V. I. Shvedov, I. A. Kharizomenova, and A. N. Grinev, Khim. Geterotsikl. Soedin., No. 1, 58 (1974).
5. M. Robba, R. Touzot, and R. Riquelme, Tetrahedron Lett., No. 44, 4549 (1972).

AMIDINES IN THE SYNTHESIS OF TETRAZOLES

P. N. Gaponik, Yu. V. Grigor'ev,
and V. P. Karavai

UDC 547.796.1'298.5

Amidines are widely used in the synthesis of nitrogen-containing heterocycles [1]; however, their use for the preparation of tetrazoles is unknown. Only the conversion of arylamidines under the influence of nitrous acid to give the so-called dihydroxytetrazotic acid has been described. The potassium salt of the latter is reduced by sodium amalgam to give a 5-substituted tetrazole in very low yield [2]. We have found that substituted amidines Ia-c react with sodium azide in acetic acid to give 1-phenyltetrazoles (IIa,b):

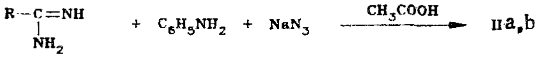


Ia-c IIa,b

I a R=R¹=H, R²=C$_6$H$_5$; b R=H, R¹=R²=CH$_3$; c R=CH$_3$, R¹=H, R²=C$_6$H$_5$; II a R=H; b R=CH$_3$

The reaction takes place at 90-100°C and gives the products in 45-60% yields after 3 h. In the case of amidine Ia it was shown that 2 moles of tetrazole IIa (90% yield) are formed when the reaction is carried out in the presence of an equimolar amount of ethyl orthoformate per mole of the amidine.

Since one of the methods for the preparation of Ia-c is transamination of unsubstituted amidines IIIa,b by primary amines [3], one might have assumed that amidines IIIa,b would act as the one-carbon component in a heterocyclization reaction via the scheme



$$\underset{NH_2}{R-C{=}NH} + C_6H_5NH_2 + NaN_3 \xrightarrow{CH_3COOH} \text{IIa,b}$$

IIIa,b a R=H; b R=CH$_3$

This reaction proceeds under the same conditions as in the preceding case and gives IIa,b in 45-65% yields.

The utilization of amidines, the synthesis of which can be accomplished by various pathways [1], significantly expands the source of 1- and 1,5-substituted tetrazoles.

A 0.8-mole sample of glacial acetic acid was added with stirring to a mixture of 0.1 mole of amidine Ia-c in the form of the acetate, methylsulfate, or free base and 0.12 mole of sodium azide, and the mixture was refluxed on a water bath for 2.5-3 h. The mixture was then cooled and filtered, and the filtrate was evaporated in vacuo. The residue was treated with 150-200 ml of a 3% solution of HCl, and the liberated oil (IIa or IIb) was crystallized in a refrigerator for 3-4 h.

The synthesis was carried out similarly starting from amidines IIIa,b, except that 0.12 mole of aniline was added after the NaN$_3$ was introduced.

Scientific-Research Institute of Physicochemical Problems, V. I. Lenin Belorussian State University, Minsk 220080. Translated from Khimiya Geterotsiklicheskikh Soedinenii, No. 4, pp. 566-567, April, 1985. Original article submitted October 29, 1984.