A MODIFIED SCHEME FOR THE SYNTHESIS OF 1-BENZYL-4,5-DIAMINO-

1,2,3-TRIAZOLE

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Amino derivatives of 1,2,3-triazole and, in particular 1-benzyl-4,5-diamino-1,2,3-triazole (I) are starting reagents for the synthesis of condensed triazole systems such as triazolopyrazines and triazolodiazepines. The synthesis of (I) described by Lovelette and Long [1] entails the condensation of benzyl azide (II) with ethyl cyanoacetate (III) to form the ethyl ester of 1-benzy1-5-amino-1,2,3-triazole-4-carboxylic acid (IVa) and a subsequent series of conversions of the ester at C<sup>4</sup> in the ring to an amine group. We have discovered that the yield of (IVa) upon its preparation at 20°C [1] and upon heating the components in ethanol at reflux [2] did not exceed 3-5%,\* which does not permit use of this procedure for preparative syntheses.

We propose the preparation of (I) according to the following modified scheme:



The key step is the cyclocondensation giving (IV). The product yield may be increased to 30% by prolonging the reaction time at 20°C from 1 h (according to Lovelette [1]) to 4 days. The reaction in methanol proceeds somewhat more rapidly, and a 30% yield is obtained after only 3 days. The PMR and thin-layer chromatographic data indicate the formation of a mixture of (IVa) and (IVb) which is smoothly converted to hydrazide (V) in the following step upon treatment with N<sub>2</sub>H<sub>4</sub>•H<sub>2</sub>O.

The most significant modification of this cyclization process is the use of high pressure. The yield of (IVa) upon carrying out the reaction of (II) with (III) in ethanol at 5 kbar and 20°C for 2 days was increased to 53%, while in methanol under the same conditions, the product [a mixture of (IVa) and (IVb)] is formed in 65% yield. The yield of (IVa) drops to 34% when carrying out this reaction in ethanol at 6 kbar and 50°C for 6 h. We should note that although the use of high pressure often permits a significant increase in the rate of chemical reactions, especially of cyclocondensation reactions [3, 4], this method has not been used for the synthesis of triazole systems.

Another important improvement in the scheme for the synthesis of (I) is the use of 20-25% HCl instead of 10% HCl as recommended by Lovelette and Long for the conversion of hydrazide (V) to carbonyl azide (VI), which permits obtaining (VI) in 90% yield. (Upon the use of 10% HCl, we obtained a 35-40% yield, in contrast to the 74% yield reported by Lovelette [1]). Finally, it is preferable to use 1.3 methanol-dichloroethane instead of ethanol in the rearrangement of (VI) to carbamate (VII) which gives an increase in yield from 52% [1] to 66%.

The proposed modifications lead to a substantial increase in the overall yield of (I) over all five steps from 0.3-0.5% [1] to 17-20%.

\*Hoover and Day [2] indicated a 16% yield of (IVa), while Lovelette and Long [1] did not indicate the yield of (IVa) obtained.

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## EXPERIMENTAL

Ethyl Ester of 1-Benzyl-5-amino-1,2,3-triazole-4-carboxylic Acid (IVa). A mixture of 8.65 g (II) and 7.9 g NCCH<sub>2</sub>CO<sub>2</sub>Et (III) was added to a solution of 1.6 g metallic sodium in 36 ml abs. ethanol and transferred to a 50-ml Teflon ampule placed within a high-pressure apparatus. The reaction mixture was maintained for 2 days at 20°C and 5 kbar. After removal of the ampule, its contents were poured into 500 ml cold water. The precipitate was filtered and washed several times with cold water and dried in vacuum over  $P_2O_5$  to give 8.4 g (53%) (IVa), mp 153-154°C [1]. Thin-layer chromatography indicated that this product did not contain impurities. A 31% yield of (IVa) was obtained upon maintaining the same components at atmospheric pressure for 4 days at 20°C. The yield of the product [a mixture of (IVa) and (IVb)] was 65% using methanol as the solvent in the reaction 5 kbar and 20°C for 2 days instead of ethanol.

The hydrazide of 1-benzy1-5-amino-1,2,3-triazole-4-carboxylic acid (V) was obtained from (IVa) or a mixture of (IVa) with (IVb) according to Lovelette and Long [1] in 95% yield, mp 197-198°C [1].

1-Benzyl-5-amino-1,2,3-triazole-4-carbonyl azide (VI) was obtained according to Lovelette and Long [1], but 20-25% HCl was used instead of 10% HCl (the same volume of acid was used) to give a 90% yield. The product decomposes at 150°C [1].

Methyl Ester of 1-Benzyl-5-amino-1,2,3-triazole-4-carbamic Acid (VII) and 1-Benzyl-4,5diamino-1,2,3-triazole (I). A mixture of 9.0 g (IV), 140 ml. abs. dichloroethane, and 50 ml abs. methanol was heated at reflux for 20 h, and the solvent was evaporated in vacuum to give 6.0 g (66%) (VII) which was converted, without further purification, to (I) according to Lovelette and Long [1] in 55% yield, mp 115°C [1].

## CONCLUSIONS

A modified scheme was proposed for the synthesis of 1-benzyl-4,5-diamino-1,2,3-triazole involving the use of high pressure (5-6 kbar) which permits a significant increase in the yield of this product.

## LITERATURE CITED

- 1. C. A. Lovelette and L. Long, J. Org. Chem., 37, 4124 (1972).
- 2. J. R. E. Hoover and A. R. Day, J. Am. Chem. Soc., 78, 5832 (1956).
- 3. B. S. El'yanov and M. G. Gonikberg, Izv. Akad. Nauk SSSR, Ser. Khim., 1044 (1967).
- 4. S. M. Makin, Yu. E. Raifel'd, and B. S. Él'yanov, Izv. Akad. Nauk SSSR, Ser. Khim., 1094 (1976).