

4-Hydroxyimino-4,5,6,7-tetrahydrobenzofurazan: A Convenient Synthesis and a Literature Correction

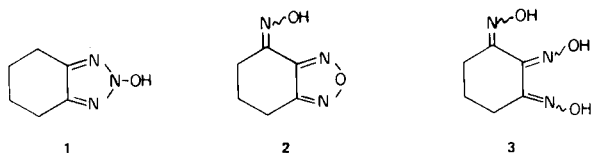
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Sir:

Recently, 2-hydroxy-4,5,6,7-tetrahydrobenzotriazole (1) was required as an intermediate for the synthesis of 2-substituted tetrahydrobenzotriazoles. It has been previously reported (2) that the reaction of the sodium salt of 2-hydroxyiminocyclohexanone (3), hydroxylamine hydrochloride, and calcium carbonate in water (Procedure A) yielded a compound, m.p. 173-174°, to which was assigned the benzotriazole structure (1). In this laboratory, the reported (2) procedure gave in 20% yield a product, m.p. 172-175°, with an infrared spectrum identical to that reported (2). However, additional spectroscopic data does not support structure 1. We have found the product to be 4-hydroxyimino-4,5,6,7-tetrahydrobenzofurazan (2) with ir, mass, pmr, and cmr spectra identical to that of a sample of 2 prepared by the method of Tokura, *et al.*, (4). This method involves the cyclization of 1,2,3-cyclohexanetrione trioxime (3) with thionyl chloride in liquid sulfur dioxide which sometimes leads to explosive reactions (4). We have found Procedure A to be a more convenient and less hazardous route to 2. Alternatively, we have also found that 2 can be conveniently prepared in 39% yield by heating an aqueous solution of 3, hydroxylamine hydrochloride and calcium carbonate (Procedure B).



EXPERIMENTAL

Melting points are uncorrected. Ir spectra were recorded on a Perkin-Elmer 137 spectrophotometer. Pmr spectra were recorded on a Perkin-Elmer R-32 spectrometer. Cmr spectra were recorded on a Varian Associates' CFT-20 spectrometer. Chemical shifts are reported in ppm downfield (δ) from internal tms. Mass spectra

were recorded on a Hitachi Perkin-Elmer RMU-6E spectrometer. Microanalyses, mass, pmr, and cmr spectra were performed by the Analytical Department of Smith Kline and French Laboratories. 4-Hydroxyimino-4,5,6,7-tetrahydrobenzofurazan (2).

(A) This procedure is essentially that reported (2) for 1 which consists of heating at reflux an aqueous (700 ml. of water) solution of the sodium salt of 2-hydroxyiminocyclohexanone (3) (40.0 g., 0.286 mole), calcium carbonate (12.0 g., 0.119 mole), and hydroxylamine hydrochloride (56.0 g., 0.80 mole) for 48 hours; allowing the mixture to set at room temperature for 3 days, filtering off the crystals with subsequent recrystallization from water (Norit) to give 8.1 g. (20%) of 2, m.p. 172-175° (Lit. (4) 167-167.5°); ir (nujol): 3250 (s) OH stretch, 1665 (W) C=N-OH stretch, 1590 (m) furazan cm^{-1} ; pmr (deuteriochloroform) δ 1.8-2.1 m (2H), 2.7-3.1 m (4H), 11.7 s (1H) exchangeable with deuterium oxide. Cmr spectrum (acetone- d_6) exhibited signals due to 6 C atoms, δ 154.38, 149.01, 146.08, 22.65, 21.09, 20.31.

Anal. Calcd. for $\text{C}_6\text{H}_7\text{N}_3\text{O}_2$: Mol. Wt. 153.145; C, 47.06; H, 4.61; N, 27.44. Found: Mol. Wt. (ms) 153; C, 46.89; H, 4.63; N, 27.73.

(B) A mixture of 1,2,3-cyclohexanetrione trioxime (3) (3.4 g., 0.02 mole), hydroxylamine hydrochloride (2.76 g., 0.04 mole), calcium carbonate (1.0 g., 0.01 mole) and 100 ml. of water was heated at reflux for 20 hours, the reaction mixture was allowed to cool, the precipitate was filtered and recrystallized from water (Norit) to give 1.20 g. (39%) of 2 as white needles, m.p. 172-173° (5). The ir, pmr and mass spectra were identical to those obtained from Procedure A.

REFERENCES

- (1) Present address, R and D Pharmaceuticals, Smith Kline and French Laboratories, 1500 Spring Garden Street, Philadelphia, Pa. 19101.
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- (3) G. Rauh, G. Smith, C. V. Banks and H. Diehl, *J. Org. Chem.*, **10**, 199 (1945).
- (4) N. Tokura, I. Shirai and T. Sugahara, *Bull. Chem. Soc., (Japan)*, **35**, 722 (1962).
- (5) The yields were considerably less when hydroxylamine hydrochloride was not used in the reaction.