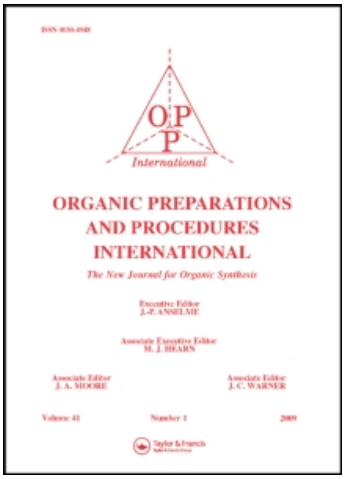

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5-METHYL- AND 5-PHENYL-1-AMINOTETRAZOLES

K. Sakai[a]; J. P. Anselme[a]
[a] Department of Chemistry, University of Massachusetts at Boston, Boston, MA

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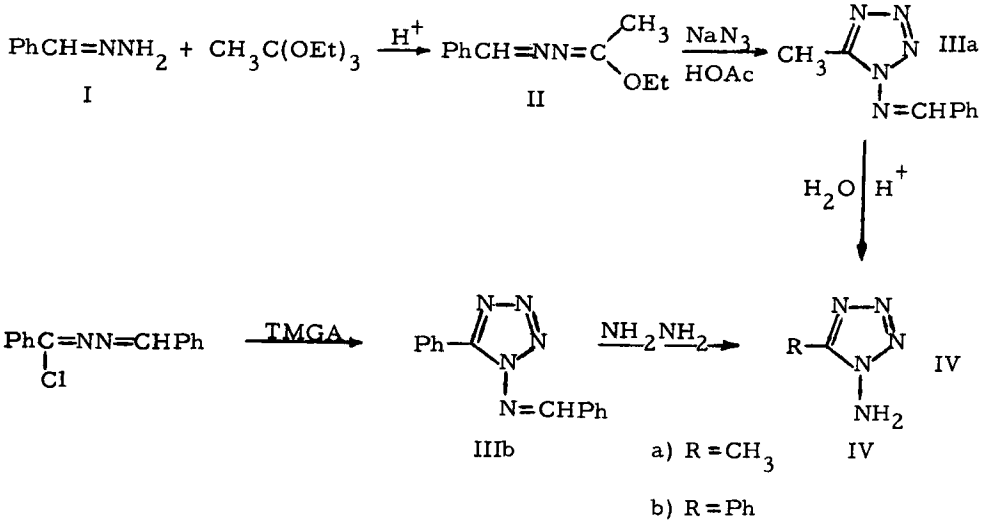
5-METHYL- AND 5-PHENYL-1-AMINOTETRAZOLES

K. Sakai and J.-P. Anselme*

Department of Chemistry
University of Massachusetts at Boston
Harbor Campus, Boston, MA 02125

As part of our continuing investigations of the oxidation of N-amino heterocycles,[1] we have prepared 5-methyl-1-amino-tetrazole (IVa) by adaptation of the procedure of Hagedorn and Winkler[2] from benzalhydrazone (I) as shown in the Scheme below. The infrared spectra of the intermediates (II and IIIa) were consistent with the assigned structures. The identity of IVa was confirmed by its vigorous decomposition to nitrogen and acetonitrile upon oxidation with lead tetraacetate.[3]



The yields of the preparation of 5-phenyl-1-aminotetrazole (IVb)[4] from α-chlorobenzalazine have been improved by using tetramethylguanidinium azide (TMGA)[5] instead of sodium azide to give 5-phenyl-1-benzalaminotetrazole (IIIb) directly, followed by cleavage of IIIb to IVb with anhydrous hydrazine. Oxidation of IVb with $Pb(OAc)_4$ yielded benzonitrile.[3]

EXPERIMENTAL

Benzalhydrazone (I).- To a solution of 66 g. (2.0 moles) of anhydrous hydrazine (95%+) in 200 ml. of anhydrous ether in a 2 ℓ. two-necked round bottom flask was added with stirring over a period of 5 hrs., a solution of 106 g. (1.0 mole) of freshly distilled benzaldehyde in 300 ml. of ether. The temperature was maintained at ~ 0° throughout the addition. The cloudy-white reaction mixture was allowed to stir for an additional 24 hours. The ethereal layer was separated and washed once with 500 ml. of cold water and dried over anhydrous sodium sulfate. Careful evaporation of the ether at room temperature in vacuo left an almost colorless oil which upon distillation in vacuo gave 74.4 g. (62%) of product, bp. 140°/14 mm. The yellow residue was identified as benzalazine by its mp. and infrared spectrum.

α-Ethoxyethylidene benzalhydrazone (II).- To 64.8 g. (0.4 mole) of triethyl orthoacetate in a two-necked round bottom flask equipped with an addition funnel and a Dean-Stark Trap, was slowly added 12 g. (0.1 mole) of benzalhydrazone. The vigorously stirred mixture was then heated to 95° and one drop of conc. sulfuric acid was added; the reaction mixture

turned pink and the ethanol which began to distil was collected in a Dean-Stark trap (20 ml). The temperature was then raised and kept at 140° for 1 hr. After cooling, enough solid sodium carbonate was added to neutralize the acid catalyst and the excess orthoester (45 ml) was removed by distillation, bp. 60-62°/30 mm. The reddish residual oil (18 g.) was distilled at 0.3 mm to give an additional 2 g. orthoester at 34-38° and 11.8 g. (62%) of II, bp. 76-78°/0.3 mm and a residue (2.0 g) which did not distill below 100°.

5-Methyl-1-benzalaminotetrazole (IIIa).- A mixture of 6.5 g. (0.034 mole) of II and 10 g. (0.15 mole) of sodium azide in 70 ml. of acetic acid was stirred at room temperature for 24 hours. Addition of 100 ml. of water precipitated the pale yellow product which was recrystallized from pet ether-benzene to give 3.4 g. (53%) of IIIa, mp. 142-143°.

5-Methyl-1-aminotetrazole (IVa).- A mixture of 4.1 g. (0.021 mole) of IIIa in 20 ml. of water and 10 ml. of conc. hydrochloric acid was steam distilled until the distillate was clear. The residual liquid was neutralized (pH paper) with conc. ammonium hydroxide to give 0.2 g. of starting material which was filtered. The filtrate was extracted with several portions of ethyl acetate and the organic extract upon evaporation, left crude IVa. Recrystallization from pet ether-benzene gave 0.8 g. (38%) of pure IVa, mp. 44-45°. An analytically pure sample was obtained by one additional recrystallization.

Calcd for $C_2H_5N_5$: C, 24.24; H, 5.09; N, 70.68
Found: C, 24.21; H, 5.09; N, 71.03

5-Phenyl-1-benzalaminotetrazole (IIIb).- A solution of 21 g. (0.86 mole) of α-chlorobenzalazine in 170 ml. of acetonitrile was added at room temperature to a solution of 15 g. (0.089 mole) of TMGA[5] in 200 ml. of acetonitrile over a period of 3 hrs. After the addition was complete, the reaction mixture was heated to reflux for 3 hrs. and poured into 300 g. of ice-water containing 10 ml. of acetic acid. The whole was extracted with ether and the ethereal solution washed with water until neutral (pH paper). The solution was dried over magnesium sulfate and evaporated at room temperature in vacuo. The residue was recrystallized from ethanol to give 20.3 g. (92%) of IIIb, mp. 105°, lit.[4] mp. 105°.

5-Phenyl-1-aminotetrazole IVb).- A mixture of 1.0 g. (0.004 mole) of IIIb and 0.8 g. (0.025 mole) of anhydrous hydrazine (95%+) in 15 ml. of ethanol was heated to reflux overnight with vigorous stirring. The mixture was evaporated to a mixture of an oil and crystals, which was left in the freezer overnight. Trituration with a small amount of ethanol gave 0.6 g. (93%) of IVb, mp. 153-154°. lit.[4] mp. 155°. Evaporation of the filtrate gave 0.4 g. of crude benzal-hydrazone.

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