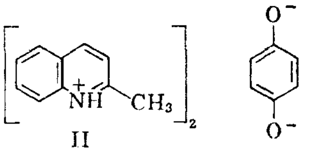
The only analogous reaction we are aware of is the report by Bell[3] of the formation of a crystalline material by the reaction of benzoquinone and quinaldine in refluxing xylene, which in subsequent work by Bothner-By[4] was shown to be II. This compound is in reality formed as an adduct of the hydroquinone and quinaldine, the hydroquinone being formed by the reduction of the quinone by the amine.



II

We have not observed the reaction for any of the other diamine-quinone systems studied,[1] and believe that the driving force in this case is the comparative stability of the *diimine* of diaminodurene. This stability has been noted by Michaelis *et al.*,[5] who report that of thirty-three C- and/or *N*-alkyl substituted and unsubstituted *p*-phenylenediamines, *only* diaminodurene has a sufficiently stable diimine to allow measurement of the equilibrium involving diamine, diimine and semiquinone radical.

The salt I is an insulator (ρ powder $\sim 10^{12}$ Ω cm.), and could be present in the charge-transfer crystals grown from benzene and responsible for the higher resistivity. The possibility of this type of reaction under mild conditions should be carefully considered in relation to any study of electrical properties of these complexes.

EXPERIMENTAL

When diaminodurene[6] (1.6 g.) and chloranil (2.5 g.) separately dissolved in benzene (total volume 1700 ml.) at room temperature were mixed, material precipitated almost immediately which was a mixture of the diaminodurene-chloranil 1:1 charge-transfer complex, a black crystalline material, and a light-colored material (approximately 1.0 g. crude). The light colored material after five recrystallizations from alcohol and sublimation decomposed at 191° and was identical in its infrared spectrum and decomposition point with the reaction product of 1:1 ratios of *tetrachlorohydroquinone* and diaminodurene mixed in ethanol, the salt I.

Anal. Calcd. for $C_{16}H_{18}Cl_4N_2O_2$: C, 46.6; H, 4.4; N, 6.8; Cl, 34.4. Found: C, 46.1; H, 4.3; N, 7.3; Cl, 33.7.

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[3] F. Bell, *J. Chem. Soc.*, 348 (1953).

[4] A. A. Bothner-By, *J. Am. Chem. Soc.*, **77**, 749 (1955).

[5] L. Michaelis, M. P. Schubert, and S. Granick, *J. Am. Chem. Soc.*, 61, 1981 (1939).

[6] L. I. Smith, *Org. Syntheses*, Coll. Vol. II, 254 (1943).

The Preparation and Characterization of 1-Methylinosine

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The reaction of diazomethane with the weakly acidic hydrogen atom of uridine was employed by Levene and Tipson[1] to prepare 1-methyluridine. The procedure has since been applied to other pyrimidine nucleosides both with and without protecting groups[2,3] on the sugar hydroxyl groups.

Bredereck and Martini[4] treated some purine nucleosides with diazomethane and applied the the name 1-methylinosine to the product of the reaction with tri-*O*-acetylinosine. While it was not unreasonable to expect this compound to result from the reaction,[5] the structure was not proved, the homogeneity of the product was not demonstrated, and no characterization was presented which would permit the compound to be recognized. An acid hydrolysis was carried out to produce, in unspecified yield, a material which was assigned the structure 1-methylhypoxanthine. The lack of proof of structure of this hydrolysis product was pointed out by Elion,[6] who has prepared 1- and 3-methylhypoxanthine by unambiguous syntheses and reported their ultraviolet spectra and paper-chromatographic behavior. As a water-soluble 1-alkylinosine of undoubted structure was needed for infrared spectroscopic studies,[7] the reaction of diazomethane with tri-*O*-acetylinosine was reinvestigated. From the heterogeneous reaction mixture, crystalline 1-methylinosine (I) was obtained and characterized

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[1] P. A. Levene and R. S. Tipson, *J. Biol. Chem.*, **104**, 385 (1934).

[2] R. E. Beltz and D. W. Visser, *J. Am. Chem. Soc.*, **77**, 736 (1955).

[3] H. T. Miles, *J. Am. Chem. Soc.*, **79**, 2565 (1957).

[4] H. Bredereck and A. Martini, *Chem. Ber.*, **80**, 401 (1947).

[5] The deacylation of esters by diazomethane has been reported [J. Herzig and J. Tichatschek, *Ber.*, **39**, 268 (1906); H. Biltz and W. Klemm, *Ann.*, **448**, 153 (1926); H. Biltz, L. Loewe, and H. Pardon, *Ber.*, **64**, 1146 (1931); H. Bredereck, R. Sieber, and L. Kamphenkel, *Angew. Chem.*, **67**, 347 (1955)] by several workers, but a careful investigation of the experimental conditions has apparently not yet been published. In the authors' experiments this aspect of the reaction appeared to be erratic, deacylation occurring in some experiments and not in others. Though this point was not specifically investigated, it appeared that prolonged contact with diazomethane (several days) would produce deacylation, whereas a few hours contact would not. Zemplen saponification of a reaction mixture in which deacylation had not occurred established that the same ring methylation products had been produced. It should be noted that the addition of ether to a methanolic solution would precipitate those compounds which had been deacetylated and leave in solution those which were still esterified.

[6] G. B. Elion, *The Chemistry and Biology of Purines*, Ciba Foundation Symposium, 1957, p. 39.

[7] H. T. Miles, *Proc. Natl. Acad. Sci.*, 47, 791 (1961) and references there cited.

for the first time, and its structure was proved with the aid of the earlier work on the hypoxanthines.[6] 6-Methoxy-9-β-D-ribofuranosylpurine, (II) the product of O-methylation, was also shown to be an important product of the reaction.

EXPERIMENTAL[8,9]

The method of Bredereck and Martini[4] was followed in allowing diazomethane to react with tri-O-acetylinosine[10] in solution in methanol and acetone.[5] The product isolated by precipitation with ether, as described, appeared to melt from ~110–120° and could not be crystallized from any of a number of different solvents. Paper chromatography in solvent system A showed two main spots at R_f 0.44 and 0.70 with some quenching material below 0.44.

In order to obtain a partial resolution of the mixture, 1 g. of the reaction product was dissolved in 1-butanol saturated with water and chromatographed on 100 g. of potato starch, using the same solvent for elution. Fractions of approximately 10 ml. were collected and the development of the column was followed by paper chromatography and ultraviolet spectroscopy.

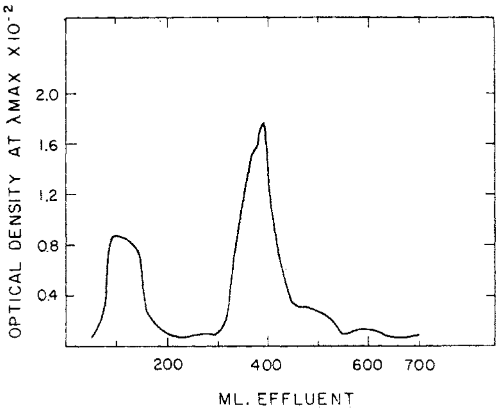

Figure 1

The elution curve is shown in Fig. 1. The first and second large peaks contained primarily the 6-methoxy and 1-methyl compounds, respectively, as demonstrated below. In addition, there was a small amount of material of λ_{max} 257 and R_f 0.55 at ~ 380 ml. of effluent, and, beginning with the trailing edge of the second large peak, material of λ_{max} 261 mμ and λ_{min} 240 mμ was eluted. These other components were not investigated further.

1-Methylinosine. The tubes from 320–460 ml. contained 400 mg. of a material of R_f 0.44. Evaporation yielded a crystalline compound of m.p. 200–205°, and recrystallization for analysis raised this value to 211–212°. The absorption spectrum had a maximum at 251 mμ (ε 10,400) and minimum at 227 mμ.

Anal. Calcd. for $C_{11}H_{14}N_4O_5$: C, 46.81; H, 5.00; N, 19.85; OCH_3, 0.00; NCH_3, 5.32. Found: C, 46.89; H, 4.95; N, 19.95; OCH_3, 0.0; NCH_3, 5.52.

As the analytical values showed that a single N—CH_3 group had been introduced, the compound had to be either 1-methyl- or 3-methylinosine. To distinguish between the two possibilities, the crystalline material was heated for 1 hr. at 100° in 5% sulfuric acid and then neutralized with barium hydroxide. The ultraviolet spectra of the hydrolysis product were measured at three pH values and compared with the spectra of authentic 1-methyl- and 3-methyl hypoxanthine, reported previously by Elion.

ULTRAVIOLET ABSORPTION MAXIMA (mμ)

pH	Acid Hydrolysis Product	1-Methyl-hypoxanthine	3-Methyl-hypoxanthine
7	251	251	264
1	249	249	253
11	260	260	265

Further confirmation of the identity of the purine was provided by a comparison of the R_f values of the hydrolysis product with those of authentic samples of 1-methylhypoxanthine and 3-methylhypoxanthine. Thus, the hydrolysis product and 1-methylhypoxanthine both moved with an R_f of 0.59 in solvent A, whereas 3-methylhypoxanthine had an R_f of 0.46. In system B, and R_f values were 0.30, 0.30, and 0.15, respectively.

It is therefore clear that the hydrolysis product is 1-methylhypoxanthine, not 3-methylhypoxanthine, and hence that the nucleoside is 1-methylinosine.

6-Methoxy-9-β-D-ribofuranosylpurine (II). The tubes from 80 to 190 ml. were pooled and found to contain a single ultraviolet-absorbing material. The R_f value (0.70 in system A) and the ultraviolet maximum (248 mμ) were the same as those of an authentic sample of II.[11] Acid hydrolysis of authentic II and of the present material gave products having the same R_f as hypoxanthine (0.49 in system A; 0.19 in system B). On the basis of the ε value reported earlier[11] these tubes contained 190 mg. of the O-methyl compound, or about 20% of the total material.

Acknowledgment. The author is indebted to Dr. Gertrude Elion for samples of 1-methylhypoxanthine and 3-methylhypoxanthine and to Dr. Howard Schaeffer for some 6-methoxy-9-β-D-ribofuranosylpurine.

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[8] Microanalyses by Joseph Alicino, Metuchen, N. J.

[9] Solvent A: 1-butanol–water–acetic acid (160:40:75). The R_f values decreased with age of solvent as esterification proceeded; solvent B: butanol saturated with water and exposed to the vapor of 3% aqueous ammonia.

[10] F. Haiser and F. Wenzel, *Monatsh. Chem.*, **39**, 157 (1908).

(11) J. A. Johnson, H. J. Thomas, and H. J. Schaeffer, *J. Am. Chem. Soc.*, **80**, 699 (1958).

2,2-Dimethyl-1,3-dioxepane

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The preparation of higher ketals from 2,2-dimethoxypropane by acid catalyzed interchange has recently been described in detail.[1] In these laboratories, we had attempted to prepare the polymeric ketal by the reaction of equimolar amounts of 1,4-butanediol and acetone dimethyl ketal through similar methods. Instead, the heretofore undescribed cyclic ketal, 2,2-dimethyl-1,3-dioxepane, resulted in about a 75% yield.

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[1] (a) N. B. Lorette and W. L. Howard, *J. Org. Chem.*, **25**, 521 (1960); (b) W. L. Howard and N. B. Lorette, *J. Org. Chem.*, **25**, 525 (1960).