Tetrahedron Letters No. 42, pp 4065 - 4066.
©Pergamon Press Ltd. 1979. Printed in Great Britain.

0040-4039/79/1015-4065\$02.00/0

PHOTOCHEMICAL REACTION OF 8-AZAXANTHINE WITH NUCLEOPHILES[1]

Isao Saito, Satoru Ito, Hiroshi Sugiyama, Munetaka Akita, and Teruo Matsuura

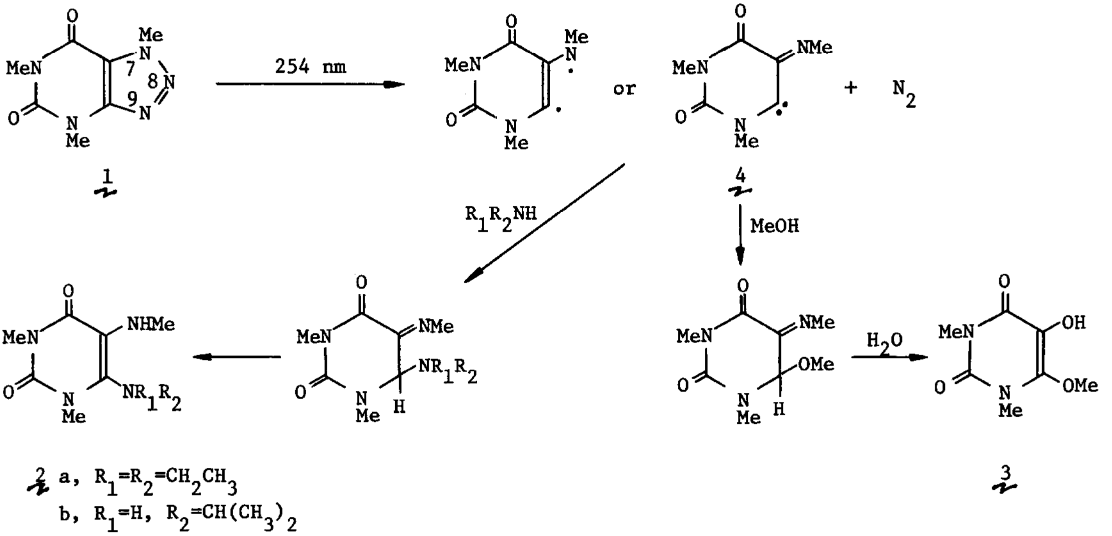
Department of Synthetic Chemistry, Faculty of Engineering, Kyoto University, Kyoto 606, Japan

Photolysis of 1,3,7-trimethyl-8-azaxanthine (**1**) in the presence of primary and secondary alkylamines gave 6-alkylamino-5-methylamino-1,3-dimethyluracils (**2**), whereas irradiation of **1** in methanol yielded 5-hydroxy-6-methoxy-1,3-dimethyluracil (**3**).

While photochemical reactions of pyrimidine bases have been the subject of extensive studies, little is known on the photoreactivity of purine bases.[2] It is generally admitted that purine bases are stable on photolysis and are capable of serving as photosensitizers in the photochemistry of nucleic acids.[2] During our investigation on the photoaddition of amino acids to nucleic acids as a model of the photo-cross-linking of proteins to nucleic acids,[3] we found that 8-azaxanthine readily undergoes photoaddition with nucleophiles such as alkylamines and alcohols with concomitant extrusion of nitrogen. Apart from a possible implication in the photobiology of nucleic acids, the reaction provides a convenient method to introduce nitrogen functions into 5 and 6 positions of pyrimidines. Recent reports by Senda et al.[4] on the photoconversion of 6-azido-1,3-dimethyluracil to 6-alkylamino-5-aminouracils have prompted us to communicate our preliminary result.

A solution of 1,3,7-trimethyl-8-azaxanthine (**1**)[5] (6.2 mmol) in acetonitrile-diethylamine (1 : 1) was irradiated by a low pressure mercury lamp (10 W, Vycol filter) under nitrogen for 24 h. Evaporation of the solvent followed by preparative TLC gave **2a**[6,7] in 66% yield. The structure of **2a** was assigned on the basis of spectral data.[7] Under similar conditions irradiation of **1** (6.2 mmol) in the presence of isopropylamine gave **2b**[6,8] (27%), whereas photolysis of **1** in methanol yielded **3**[6,9] (22%) together with complex mixture of products. The formation of **2** and **3** suggests a carbene precursor such as **4** rather than a 1,3-biradical or an azirine intermediate.[10] Photolysis of 1,3,9-trimethyl-8-azaxanthine or 1,3-dimethyl-8-azaxanthine did not yield the corresponding adduct under the conditions, indicating that an alkyl substituent at 7 position is necessary for the present photoreaction.

Highly reactive nature of 8-azaxanthine system on photolysis, in contrast to the *photostability*[2] of purines, may provide a mean for photochemical affinity labeling of biological systems.



REFERENCES AND NOTES

1. Photoinduced Reactions. 113
2. (a) D. Elad, in "Photochemistry and Photobiology of Nucleic Acids", Vol. 1, S. Y. Wang Ed., Academic Press, New York, N. Y., 1976, p 357; (b) I. Saito and S. Ito, J. Syn. Org. Chem., Japan, 36, 1009 (1978).
3. (a) I. Saito, S. Ito, and T. Matsuura, J. Am. Chem. Soc., 100, 2901 (1978); (b) I. Saito, S. Ito, and T. Matsuura, Tetrahedron Lett., 2585 (1978); (c) S. Ito, I. Saito, A. Nakata, and T. Matsuura, Nucleic Acids Res., Sp., No 5, 334 (1978); (d) S. Ito, I. Saito, and T. Matsuura, submitted to Tetrahedron Lett.
4. (a) S. Senda, K. Hirota, T. Asao, and K. Maruhashi, J. Am. Chem. Soc., 100, 7661 (1978); (b) S. Senda, K. Hirota, and T. Asao, Tetrahedron Lett., 1531 (1978).
5. (a) H. U. Blank and J. J. Fox, J. Am. Chem. Soc., 90, 7175 (1968); (b) G. Nübel and W. Pfleider, Chem. Ber., 98, 1060 (1965).
6. Satisfactory elemental analyses and mass spectral data were obtained for the compounds.
7. Bp 142 °C/1 mmHg; NMR ($CDCl_3$) δ 1.11 (t, J = 7.2 Hz, 6 H), 2.57 (s, 3 H), 3.01-3.24 (br, 1 H, NH), 3.19 (q, J = 7.2 Hz, 4 H), 3.36 (s, 3 H), 3.37 (s, 3 H); UV λ_{max} (EtOH) 210 (log ε, 3.97), 303 nm (3.48).
8. Bp 140 °C/0.3 mmHg; NMR ($CDCl_3$) δ 1.21 (d, J = 6.4 Hz, 6 H), 2.03-2.43 (br, 1 H, NH), 2.52 (s, 3 H), 3.34 (s, 3 H), 3.42 (s, 3 H), 3.34-3.78 (m, 1 H), 4.86-5.10 (br, 1 H, NH); UV λ_{max} (EtOH) 209 (log 4.07), 288 nm (4.01).
9. Mp 158-162 °C; NMR ($CDCl_3$) δ 3.35 (s, 3 H), 3.38 (s, 3 H), 4.24 (s, 3 H), 5.39 (s, 1 H, OH); UV λ_{max} (EtOH) 206 (log ε 3.96), 281 nm (3.99).
10. For analogous photoelimination of nitrogen from triazoles and benzotriazoles, see R. H. Kellog in "Photochemistry of Heterocyclic Compounds", O. Buchardt Ed., Wiley, New York, N. Y., 1976, p 406.

(Received in Japan 7 July 1979)