Tetrahedron Letters, Vol.32, No.41, pp 5823-5824, 1991
Printed in Great Britain

0040-4039/91 $3.00 + .00
Pergamon Press plc

PHOTOLYSIS OF N-2,4,6-TRINITROPHENYL SUBSTITUTED AMINO ACIDS.

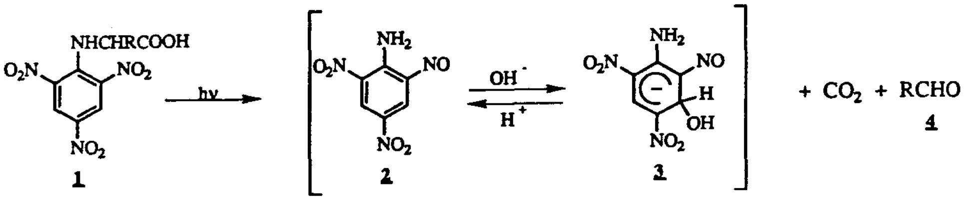
John Frederiksen, Bjarne D. Larsen and Niels Harrit.[*]

Department of General and Organic Chemistry,
The H.C.Ørsted Institute, University of Copenhagen,
Universitetsparken 5, DK-2100, Copenhagen Ø, Denmark.

Abstract. Photolysis of N-2,4,6-trinitrophenyl substituted amino acids (**1**) in weakly basic aqueous solution and methanol leads to formation of 2-nitroso-4,6-dinitro-aniline (**2**), carbon dioxide and the aldehyde (**4**) with one carbon less than the amino acid.

In solid-state peptide synthesis it is desirable to develop photoremovable protection groups for the α-amino group. Nitrosubstituted phenyl groups may have this potential considering the reported light-sensitivity of N-2,4-dinitrophenyl substituted amino acids.1-4) Regarding their N-2,4,6-trinitrophenyl (TNP) counterparts, however, only a single short-communication on their photochemical reactivity has appeared.5) According to this, photolysis in dilute hydrochloric acid of TNP-amino acids and TNP-dipeptides leads to 2,4,6-trinitroaniline (picramide).

We have reinvestigated the latter reaction and found the principal product to be 2-nitroso-2,6-dinitroaniline (**2**) or its Meisenheimer-complex with OH^- (**3**) as outlined in the scheme:



Scheme 1.

Compound **2** was isolated as brown crystals after preparative photolysis of N-(2,4,6-trinitrophenyl) leucine (**5**) and 2-(2,4,6-trinitrophenylamino)-octanoic acid (**6**) dissolved (1 mM) in 1% aquous $NaHCO_3$ (pH=8). Substantial degradation occured during work-up (acidification, extraction, column chromatography, recrystallisation 70% EtOH under N_2). The identity of the product was established by comparison (mixed melting point, IR, ^1H- and ^{13}C-NMR, MS, CHN-analysis) with authentic **2**.6) When N_2 was led through the solution during photolysis and subsequently through aqueous $Ba(OH)_2$, a precipitate was formed, which was identified as $BaCO_3$. 3-methylbutanal (from 5) and heptanal (from 6) was identified in the photolysis mixture as their 2,4-dinitrophenylhydrazones. Heptanal (from 6) could furthermore be detected by GLC and comparison with authentic material.

The reactions was also examined by means of UV/VIS-spectroscopy in MeOH and in 1% $NaHCO_3$ (Figure 1).

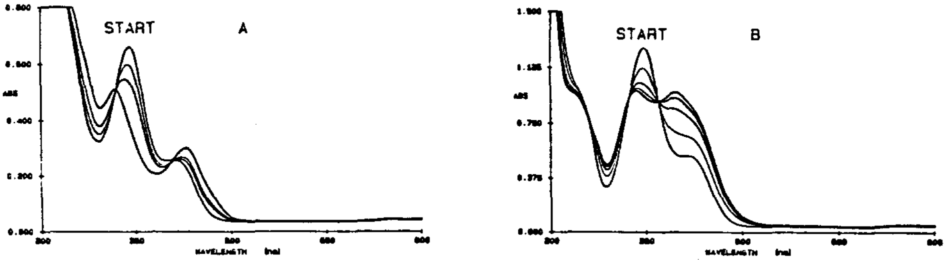


Figure 1. UV-spectra recorded during photolysis (λ=350 nm) of 6.
A: In MeOH (4.1 x 10^{-5} M). B: In 1 % $NaHCO_3$ (7.6 x 10^{-5} M)

In Figure 1(A) the spectrum of 5 (λ_{max} 410 nm (sh)) is gradually replaced by the spectrum of 2 (λ_{max} 430 nm $^{6)}$). In Figure 1(B) the long-wavelength maximum of the anionic form of 6 at 416 nm is shifted to 397 nm during photolysis. This absorption is assigned to the Meisenheimer-complex (3) between hydroxide ion and 2. The corresponding complex between methoxide ion and 2 absorbs at ca. 390 nm.$^{6)}$ Independent experiments proved the acid/base induced interconversion of 2 and 3 to be reversible. According to analysis of the spectral course of the reaction, 2 (or 3) is the only product formed by photolysis of 5 in methanol (or 1% $NaHCO_3$) which absorbs above 300 nm.

Experiments equivalent to that displayed in Figure 1(B) were performed on the TNP-substituted amino acids glycine, valine, isoleucine and glutamic acid in 1 % $NaHCO_3$. TNP-gly and TNP-ile was also examined in 1 N HCl. They all reacted in analogy to Scheme 1 and formed 2 or 3 according to pH. TNP-tryptophan, however, reacted very reluctantly (1 % $NaHCO_3$), forming different and yet unidentified products. Standing in the dark, all solutions were completely stable for days.

1) D.W. Russell, Biochem. J., 1963, 87, 1; J.Chem.Soc., 1963, 894; ibid., 1964, 2829.
2) D.J. Needle and R.J. Pollitt, J.Chem.Soc.(C)., 1967, 1764; ibid., 1969, 2127.
3) O. Meth-Cohn, Tetrahedron Lett., 1970, 1235.
4) P.H. MacFarlane and D.W. Russell: Tetrahedron Lett., 1971, 725
5) K. Satake and T. Okuyama, Bull. Chem. Soc. Jpn., 1959, 32, 526.
6) V. Machacek, M.M.M. Hassanien, V. Sterba and A. Lycka, J.Chem.Soc. Perkin Trans. II, 1987, 876.

(Received in UK 29 July 1991)