

FACILE CONVERSION OF AZIDES TO AMINES

Samarendra N. Maiti, Maya P. Singh and Ronald G. Micetich*
Faculty of Pharmacy and Pharmaceutical Sciences, University of Alberta,
Edmonton, Canada T6G 2N8

Summary: A simple method for the reduction of azides to primary amines is described.

The azido group has been used extensively in organic synthesis especially for the introduction of primary amino group by the reduction of the azide. The reagents commonly employed for this purpose are LAH, NaBH₄ or catalytic hydrogenation over nickel, palladium-carbon or platinum oxide. Additional reduction methods reported in the literature¹ but rarely used include the use of sodium bisulphite, sodium arsenite, titanous chloride and sodium-ethanol. A few recent methods include Cr(II)/H⁺², Ph₃P/NH₄OH³, H₂S/pyridine/water⁴, Na₂S/MeOH/NEt₃⁵, propane -1,3-dithiol⁶ and H₂/Lindlar catalyst⁷. In a search for a mild, convenient method for the reduction of azides to the corresponding amines we have studied various other reducing agents. The use of stannous chloride is well established in organic synthesis for the reduction of the nitro group. However little attention has been focussed on the reaction of stannous chloride with organic azides. In this communication we report preliminary results of the reduction of some organic azides with stannous chloride in methanol as solvent. When this reduction method was applied to cinnamyl azide, under appropriate conditions cinnamyl amine was directly obtained in almost quantitative yield (Ca. 98%). The table summarises the results of the reduction of a number of organic azides. In the case of less reactive azides like heptyl and decyl azides the reaction could be initiated by adding a catalytic amount of anhydrous aluminium chloride. The rate of reduction varies considerably with the electronic environment of the azido group. Usually the reaction was complete within an hour and the completion of the reaction was followed by TLC.

Table. Reduction of Azides with Stannous chloride

Starting azides	Reaction Time(h)	Yield(%)
CH ₃ (CH ₂) ₅ CH ₂ N ₃	1.0	85
CH ₃ (CH ₂) ₈ CH ₂ N ₃	1.0	88
C ₆ H ₁₁ N ₃	0.5	88
C ₆ H ₅ N ₃	0.25	90
C ₆ H ₅ CH ₂ N ₃	0.5	95
C ₆ H ₅ CH=CHCH ₂ N ₃	0.5	98

The azides used, except phenyl azide⁸, were prepared by nucleophilic displacement using sodium azide and the corresponding bromide as reactants in presence of Aliquat 336 as a phase transfer catalyst according to the literature procedure⁹.

Work is now in progress to define the scope and limitations of this novel method of azide reduction and the results will be the subject of a forthcoming publication.

Reduction of Azides: Representative procedure

To a stirred suspension of 10.9 g (.0487 mole) of stannous chloride in methanol (40 ml), benzyl azide (4 g, .0325 mole) was added dropwise. The reaction was exothermic and N₂ gas was evolved. After the addition was over the mixture was stirred at room temperature for a total period of 0.5 h. Methanol was removed under reduced pressure, the residue was diluted with cold water and made alkaline with sodium hydroxide. Ether was added (if necessary the precipitated inorganic material could be filtered off at this stage) and the layers separated. The aqueous layer was saturated with sodium chloride and re-extracted with ether. The combined ether layers were dried (Na₂SO₄) and concentrated to give benzyl amine identified by comparison with authentic benzylamine in 95% yield.

REFERENCES

1. S. Patai, "The chemistry of Azido Group", Interscience publishers, John Wiley and Sons, 1971, pp. 333-338.
2. D.N. Kirk and M.A. Wilson, J.Chem.Soc.Chem.Comm., 1970, 64; T. Kondo, H. Nakai and T. Goto, Tetrahedron, 1973, 29, 1801.
3. W.S. Mungall, G.L. Greene, G.A. Heavner and R.L. Letsinger, J.Org.Chem., 1975, 40, 1659; M. Vaultier, N. Knouzi and R. Carrie, Tet.Letters, 1983, 24, 763.
4. T. Adachi, Y. Yamada, I. Inoue and M. Saneyoshi, Synthesis, 1977, 45.
5. B.A. Belinka and A. Hassner, J.Org.Chem., 1979, 44, 4712.
6. H. Bayley, D.N. Standring and J.R. Knowles, Tet.Letters, 1978, 3633.
7. E.J. Corey, K.C. Nicolaou, R.D. Balanson and Y. Machida, Synthesis, 1975, 590.
8. R.O. Lindsay and C.F.H. Allen, Org.Synth.Coll.Vol. 3, p. 710.
9. W.P. Reeves and M.L. Bahr, Synthesis, 1976, 823.

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