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AZIDE SYNTHESIS WITH STABLE NITROSYL SALTS

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Summary: Aryl and acyl hydrazines were converted to azides in excellent yields by an equimolar amount of nitrosyl tetrafluoroborate or nitrosyl sulfate.

The importance of azides as versatile intermediates in organic syntheses has been highlighted and their syntheses referenced in recent papers[1,2] in this Journal. Two new methods were proposed[1,2] which involve conversion of hydrazines to azides by "clayfen"[1] and dinitrogen tetroxide[2] that function as sources of nitrosyl ion (NO^+) which is the electrophilic species initiating[3] the conversion via the intermediacy of an unstable β-nitroso hydrazine derivative.[2] In this publication we wish to report a method to convert hydrazines to azides, which avoids the long reaction times and high temperatures reported[1] with "clayfen" or the use of gaseous dinitrogen tetroxide[2] which is cumbersome to handle and exactly quantitate.

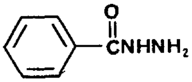
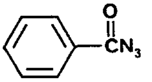
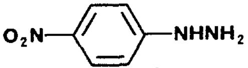
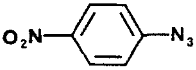
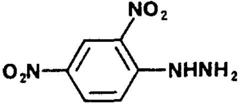
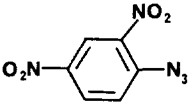
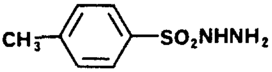
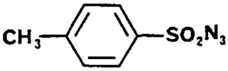
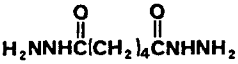
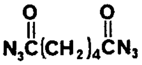
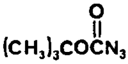
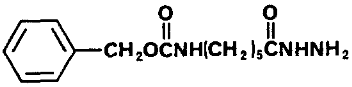
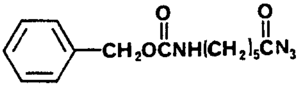
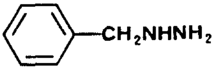
Publications by Oláh *et al.*[4,5] on reactions with stable nitrosyl salts such as $NOBF_4$ (1), $NOHSO_4$, $NOPF_6$, $NOSbF_6$ and $NOAsF_6$ led to the idea that these salts might be preparatively useful reagents for the hydrazine → azide transformation. And indeed, it was found that both $NOBF_4$[6] and $NOHSO_4$[6] rapidly converted various hydrazines to the corresponding azides at low temperatures in excellent yields.

In a typical example, 1 (240 mg) was added in one portion to a stirred solution of 2,4-dinitrophenylhydrazine (374 mg) in dry dichloromethane (5 mL) at -40°. The mixture was allowed to reach room temperature in ca. 10 min. Extractive work-up (water) followed by chromatography (hexane-ether, 3:1) gave pure 2,4-dinitrophenyl azide (86%). Other examples are found in the TABLE. Entry 7 exemplifies that the novel procedure can also be used for the preparation of N-protected aminoacyl azides which are useful, activated intermediates in peptide synthesis[7] whilst entry 8 supports an earlier statement[1] that "alkyl azides are not obtained by nitrosation of alkyl hydrazines."

The efficiency of the conversion and the advantage of simplicity in handling the reagents proposed in this communication should make our procedure a useful alternative to published methods[1,2] of preparation of azides from hydrazines.

TABLE

Conversion of hydrazines to azides by $NOBF_4$[a]

Entry	Substrate	Product[b]	Isolated yield (%)	Ref.
1			58[c]	1
2			84	8
3			86	9
4			85	1
5	 $H_2NNH\overset{O}{\overset{\Vert}{C}}(CH_2)_4\overset{O}{\overset{\Vert}{C}}NHNH_2$	 $N_3\overset{O}{\overset{\Vert}{C}}(CH_2)_4\overset{O}{\overset{\Vert}{C}}N_3$	74	-
6	 $(CH_3)_3CO\overset{O}{\overset{\Vert}{C}}NHNH_2$	 $(CH_3)_3CO\overset{O}{\overset{\Vert}{C}}N_3$	48[d]	10
7			95[c]	-
8		—	-	-

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[a] Nitrosyl sulfate in acetonitrile was found to be an equally suitable reagent. [b] Identity of products was confirmed by direct comparison with authentic azides obtained by established procedures. [c] Isolated as a solid by filtration of the reaction mixture. [d] Reaction was conducted at -40° and was quenched with aqueous $NaHCO_3$ solution. [e] Reaction with allyl amine gave the corresponding allylamide in 83% yield.

References

1. P. Laszlo and E. Polla, Tetrahedron Lett., 25, 3701 (1984).
2. Y. H. Kim, K. Kim and S. B. Shim, Tetrahedron Lett., 27, 4749 (1986).
3. K. Clusius and K. Schwarzenbach, Helv. Chim. Acta, 41, 1413 (1958).
4. G. Oláh, L. Noszkó, S. Kuhn and M. Szelke, Chem. Ber., 89, 2374 (1956).
5. G. A. Oláh and J. A. Oláh, J. Org. Chem., 30, 2386 (1965).
6. Nitrosyl tetrafluoroborate and nitrosyl sulfate are commercially available white solids, which can be stored at +4° without any apparent loss of activity. No special precautions were taken in their handling.
7. P. Stenzel, Methoden der Organischen Chemie (Houben-Weyl), 15/2, 296 (1974).
8. E. Lieber, T. S. Cao and C. N. R. Rao, J. Org. Chem., 22, 654 (1957).
9. A. S. Bailey and F. R. Case, Tetrahedron, 3, 113 (1958).
10. L. A. Carpino, J. Am. Chem. Soc., 28, 1909 (1963).

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