

SYNLETT Spotlight 147

Sodium Nitrite (NaNO₂)

Compiled by Dan Bernardi

This feature focuses on a reagent chosen by a postgraduate, highlighting the uses and preparation of the reagent in current research

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Introduction

The well-known NaNO₂ (mp 271 °C, d = 2.17) has multiple applications in organic synthesis but also in medicine as a vasodilator, bronchodilator and antidote against cyanide and H₂S poisoning. It is produced in the human body from saliva and sodium nitrate to control bacteria in the stomach.

The synthetic utilities of NaNO₂ have been extensively investigated in organic chemistry. Nitrosation of primary amines with nitrous acid (generated in situ from sodium nitrite and a strong acid) leads to diazonium salts. These salts are useful synthetic intermediates used in named reactions like Sandmeyer, Balz-Schiemann,¹ Pschorr,² and Heck³ or in the manufacture of diazo dyes.⁴ NaNO₂ is

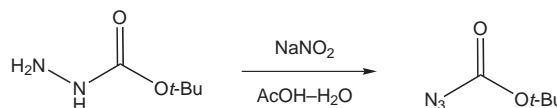
also used in the synthesis of alkyl nitrites,⁵ reagents used for the synthesis of diazonium salts in non-aqueous media⁶ or for the diazotization of primary aliphatic amines⁷ in DMF.

NaNO₂ reacts with SO₂ and potassium hydrogen carbonate to afford potassium hydroxylaminedisulfonate salt, which gives after oxidation nitrosodisulfonic acid dipotassium salt. This Fremy's salt is a useful reagent for the selective oxidation of phenols and aromatic amines to quinones (the Teuber reaction).⁸

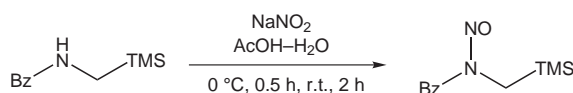
Hydroxylamine hydrochloride is synthesized from NaNO₂ in a three-step procedure.⁹

Abstracts

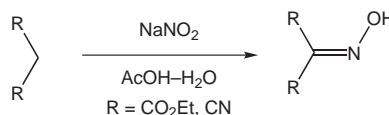
(A) *tert*-Butylcarbazate reacts with NaNO₂ in an aqueous media to afford *tert*-butyl azidoformate¹⁰ which is a convenient reagent for the acylation of amine, hydrazine and similar compounds.¹¹



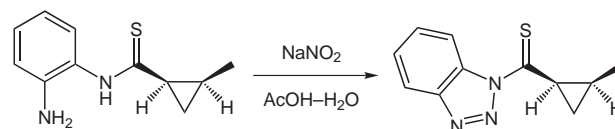
(B) *N*-Nitroso derivatives¹² of secondary amines are prepared by the action of NaNO₂ in aqueous acetic acid. The latter can be reduced by LiAlH₄ to give the corresponding hydrazine derivatives.



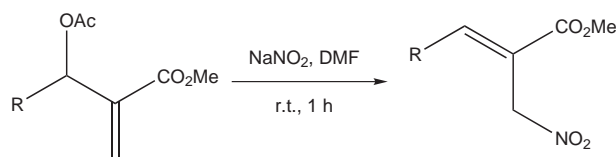
(C) Oximes¹³ can also be easily obtained from malonates or malononitrile and NaNO₂ under very mild conditions. Reduction of the oxime allows the formation of the amino derivative.



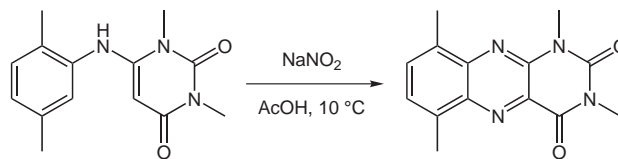
(D) The benzotriazole ring system¹⁴ is built from monoacyl-*o*-phenylene diamine and NaNO₂ in aqueous acetic acid.



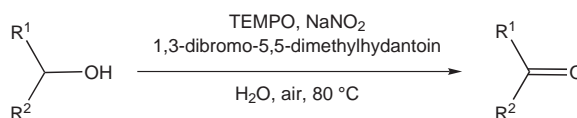
(E) NaNO_2 is a very useful reagent for the production of simple aliphatic nitro compounds.¹⁵ An example from α,β -enones is shown here.



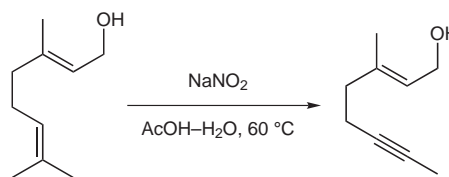
(F) Lindén et al.¹⁶ have used NaNO_2 in the formation of a tricyclic alloxazines. Nitrite was the key reagent for this ring-closure step.



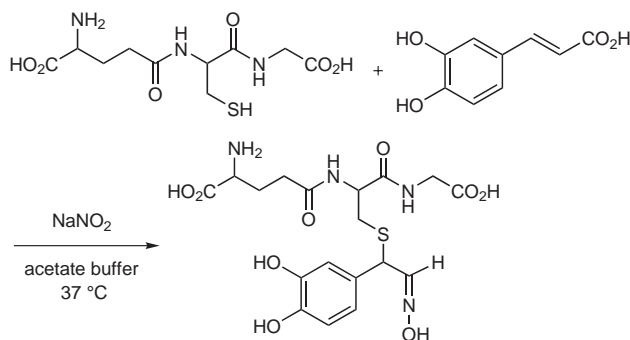
(G) Liu et al.¹⁷ have shown the utility of NaNO_2 as a cocatalyst for the oxidation by TEMPO of alcohols to ketones in water.



(H) Abidi¹⁸ converted the isopropylidene group in geraniol chain into an alkyne group by the action of an excess of NaNO_2 in acetic acid.



(I) Panzella et al.¹⁹ showed that NaNO_2 in acetate buffer (0.05) M mediated the decarboxylative conjugation of caffeic acid with glutathione under mildly acidic conditions.



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