

SYNLETT Spotlight 233

N-Iodosaccharin (NISac)

Compiled by Ankita Rai



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

Ankita Rai was born in Ghazipur, U.P., India in 1981. She received her B.Sc. (2004) and M.Sc. (2006) degrees from the University of Allahabad. Presently, she is working towards her Ph.D. degree under the supervision of Prof. L. D. S. Yadav, at the University of Allahabad. Her research is focused on the development of new synthetic routes to bioactive heterocyclic scaffolds from biorenewable resources using microwave methodology and nano-catalysis in the context of green chemistry.

Green Synthesis Lab, Department of Chemistry, University of Allahabad, Allahabad 211 002, U.P., India
E-mail: ankitagalaxy@gmail.com

Dedicated to my honorable mentor Prof. L. D. S. Yadav

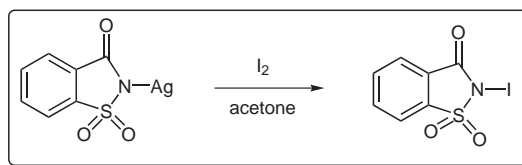
Introduction

Organic iodine compounds are interesting as such or as synthetic intermediates because iodine is an excellent leaving group and can be replaced with other groups in numerous reactions. Introduction of an iodine atom into organic molecules is sometimes difficult due to the weakness of the carbon–iodine bond. For electrophilic iodination, more reactive reagents are those in which the iodine atom is made more electropositive.^{1,2} *N*-iodosaccharin (NISac) is a new reagent³ of this class, proven as a versatile reagent for electrophilic iodination and other applications.⁴ NISac works as a moderately electrophilic halogenating agent which can be used under neutral conditions. It works as a potent iodinating agent and has great importance in the mild hydrolysis of certain compounds.

Preparation of *N*-iodosaccharin:⁴

The synthesis of *N*-iodosaccharin (NISac) can be achieved by following the classical procedure used for the

preparation of *N*-haloamides, that is the reaction of a silver salt of saccharin with iodine.⁵ The reaction is carried out in the presence of a neutral solvent like acetone. Interestingly, the compound crystallizes as a crystallohydrate with one equivalent of water which was gained presumably from the air moisture. Under very dry conditions the product may contain less than one equivalent of water but the exact composition can be easily determined by iodometric titration. NISac is a stable compound which can be stored at room temperature. It is soluble in common organic solvents (better in more polar ones such as acetone or acetonitrile) and insoluble in water.

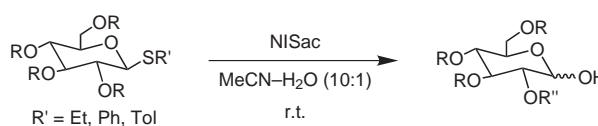


Scheme 1

Abstracts

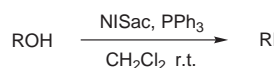
(A) Hydrolysis of Thioglycosides:

There are several recent reports on the utilization of *N*-iodosaccharin for the mild hydrolysis of thioglycosides^{6,7} to the corresponding hemiacetals.^{8,9}



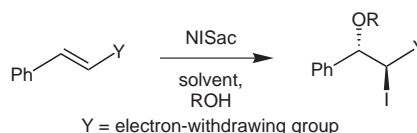
(B) Iodination of Alcohols:

Firouzabadi et al. have reported the conversion of alcohols into the corresponding iodides in good to excellent yields using NISac at room temperature under neutral conditions in the presence of triphenylphosphine.¹⁰



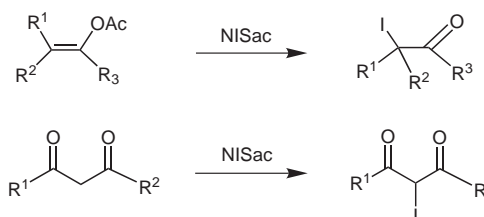
(C) Formation of Halohydrins:

NISac reacts with electron-deficient alkenes,¹¹ such as α,β -unsaturated ketones, acids, esters and nitriles, in aqueous organic solvents to afford the corresponding iodohydrins^{12–14} in good yields.



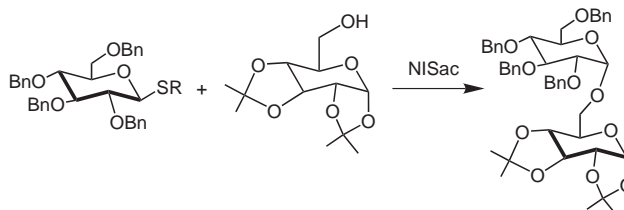
(D) Iodination of Enol Acetates and 1,3-Diones:

Dolenc has demonstrated that iodination of enol acetates and 1,3-diones with *N*-iodosaccharin is clean, proceeds faster, and is usually completed in few minutes at room temperature in acetonitrile or acetone.¹⁵



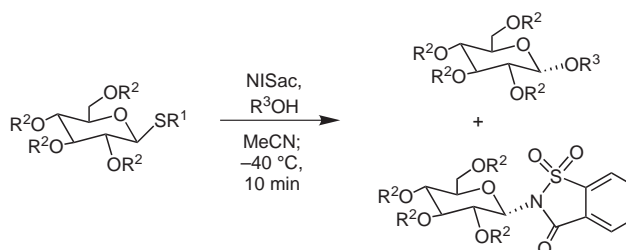
(E) Stereoselective Formation of a Glycosidic Linkage:

The stereoselective formation of a glycosidic linkage is one of the most challenging aspects of oligosaccharide synthesis, and this is well-mediated by the iodonium ion from NISac.¹⁶



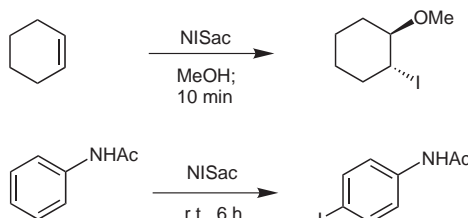
(F) Oligosaccharide Synthesis:

Thioglycosides have become extremely popular as glycosyl donors for oligosaccharide synthesis. Amongst the many reported methods for thioglycoside activation involving treatment with a source of I^+ , the use of NISac alone has the potential to efficiently promote activation of thioglycosides without the need for the addition of any other co-activator.⁵



(G) Iodination of Alkenes and Aromatics:

Dolenc has reported that *N*-iodosaccharin smoothly iodates alkenes and activated aromatics such as aniline and phenols.⁴ Hydroxyl groups and aldehydes do not react under the reaction conditions. Addition on alkenes follow the Markovnikov rule with very high regioselectivity to afford adducts of iodine and the nucleophile depending on the solvent used.⁴



References

- (1) Gokel, G. W. *Dean's Handbook of Organic Chemistry*, 2nd ed.; Mc-Graw Hill: New York, **2004**.
- (2) Chambers, D. J.; Fairbanks, A. J. *Electronic Encyclopedia of Reagents for Organic Synthesis*; John Wiley & Sons, **2003**.
- (3) Kolvari, E.; Ghorbani-Choghamarani, A.; Saheli, P.; Shirini, F.; Zolfigol, M. A. *J. Iran. Chem. Soc.* **2007**, *4*, 126.
- (4) Dolenc, D. *Synlett* **2000**, 544.
- (5) Aloui, M.; Fairbanks, A. J. *Synlett* **2001**, 797.
- (6) Dinkelaar, J.; Witte, M. D.; Van den Bos, L. J.; Overkleft, H. S.; Van der Marel, G. A. *Carbohydr. Res.* **2006**, *341*, 1723.
- (7) Dasgupta, S.; Roy, B.; Mukhopadhyay, B. *Carbohydr. Res.* **2006**, *341*, 2708.
- (8) Mandal, P. K.; Misra, A. K. *Synlett* **2007**, 1207.
- (9) Misra, A. K.; Agnihotri, G. *Carbohydr. Res.* **2004**, *339*, 885.
- (10) Firouzabadi, H.; Iranpoor, N.; Ebrahimzadeh, F. *Tetrahedron Lett.* **2006**, *47*, 1771.
- (11) de Souza, S. P. L.; da Silva, J. F. M.; de Mattos, M. C. S. *J. Braz. Chem. Soc.* **2003**, *14*, 832.
- (12) Urankar, D.; Rutar, I.; Mordec, B. *Eur. J. Org. Chem.* **2005**, 2349.
- (13) Boukhris, S.; Souizi, A. *Tetrahedron Lett.* **2003**, *44*, 3259.
- (14) Cerritelli, S.; Chiarini, M.; Cerichelli, G.; Capone, M.; Marsili, M. *Eur. J. Org. Chem.* **2004**, 623.
- (15) Dolenc, D. *Synth. Commun.* **2003**, *33*, 2917.
- (16) Aloui, M.; Fairbanks, A. J. *Chem. Commun.* **2001**, 1406.