

SYNLETT Spotlight 173

Sodium Perborate (SPB)

Compiled by Maliheh Safaiee



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

Maliheh Safaiee was born in Saveh, Iran in 1976. She received her B.Sc. in chemistry from the Bu-Ali Sina University, Iran and her M.Sc. in organic chemistry from the same university under the guidance of Prof. M. A. Zolfigol. She is currently working towards her Ph.D. under the supervision of Professor D. Habibi at Bu-Ali Sina University. Her research interests include the development of new organic methodology.

Department of Chemistry, Bu-Ali Sina University,
Hamadan Zip Code 6517838683, Iran
E-mail: msafaiee@basu.ac.ir

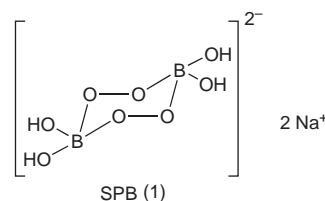
Introduction

Sodium perborate (SPB) has the empirical formula $\text{NaBO}_3 \cdot x\text{H}_2\text{O}$. Two commercially available forms correspond stoichiometrically to $x = 1$ or 4, and are known as the monohydrate and tetrahydrate.¹

SPB was shown in 1961 to be the disodium salt of 1,4-diboratetroxane dianion (**1**). Hence, the monohydrate actually corresponds to the anhydrous salt, and the tetrahydrate to a hexahydrated form of it. SPB is a convenient source of H_2O_2 , the borate helping somewhat to buffer, stabilize against decomposition, and activate towards nucleophilic oxidations, through associated species such as $[\text{B}(\text{OH})_3(\text{OOH})]^{2-}$.

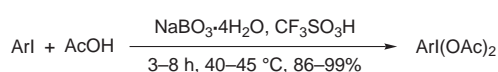
Sodium perborate is a cheap, stable, non-toxic oxidizing agent, easily handled, crystalline, easily available peroxygen compound and has industrial application.³

Sodium perborate has been used for a variety of oxidation reactions. This reagent can be applied to the synthesis of amides from nitriles,⁴ quinazoline-4-(3*H*)-ones from *o*-amido benzonitriles,⁵ sulfoxides from sulfides,⁶ esters from cyclic acetals,⁷ carbonyl compounds from oximes,⁸ aldehydes from terminal alkenes,⁹ the synthesis of aryl thiocyanates¹⁰ and Corey aldehyde,¹¹ and transesterification of β -keto esters.¹²

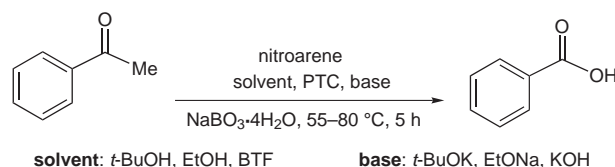


Abstracts

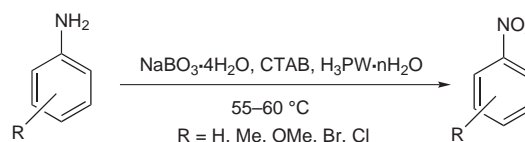
(A) Sodium perborate has been employed as an efficient catalyst for the preparation of (diacetoxyiodo)arenes from iodoarenes.¹³



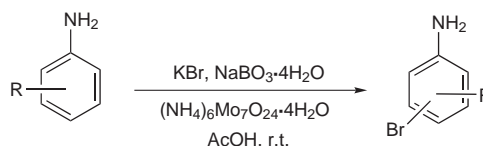
(B) Bjorsvik et al. reported a new catalytic oxidation method for the preparation of aromatic carboxylic acids from methyl aryl ketones. The catalytic cycle is based on the use of an electron-deficient nitroarene as a catalyst with either one of the two cheap and green oxidants sodium perborate or sodium percarbonate.¹⁴



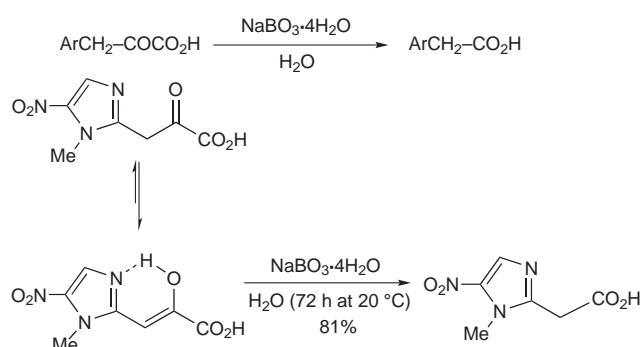
(C) Several primary aromatic amines, substituted with electron-donating groups, were converted into their corresponding nitro compounds in good to excellent yield with sodium perborate tetrahydrate (SPB) in micellar media in the presence of a catalytic amount of tungstophosphoric acid ($\text{H}_3\text{PW} \cdot n\text{H}_2\text{O}$).¹⁵



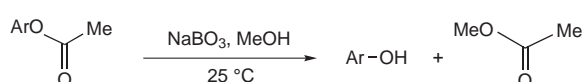
(D) Roche et al. reported the selective monobromination of various deactivated anilines using potassium bromide and sodium perborate. The use of ammonium molybdate as catalyst accelerates the rate of reaction but is not essential to obtain good yields and high selectivities.¹⁶



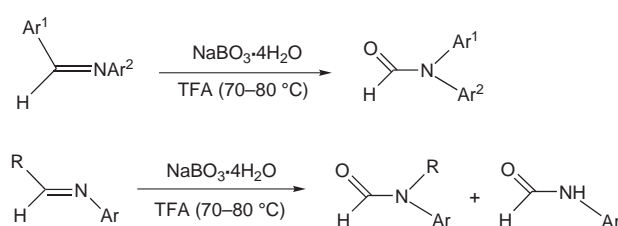
(E) Decarbonylation of β -aryl and β -heterocycle pyruvic acids catalyzed by sodium perborate tetrahydrate in aqueous solution at ambient temperature give the corresponding arylacetic acids in good yield.^{17,18}



(F) Bandgar et al. show unique selectivity and constitute a useful alternative to commonly accepted deacylation procedures. Moreover, the superiority and flexibility of the protocol lies in its ease of operation and simplicity in work-up which involves mere filtration of the reagent. Clean deprotection under mild and neutral conditions using this cheap and easily available reagent make this simple protocol economically attractive.¹⁹



(G) Rearrangement of aldimine to formamide is another application of sodium perborate. *C,N*-Diarylaldehydes and *C*-alkyl-*N*-arylaldehydes undergo this rearrangement.²⁰



References

- McKillop, A.; Sanderson, W. R. *Tetrahedron* **1995**, *51*, 6145.
- McKillop, A.; Sanderson, W. R. *J. Chem. Soc., Perkin Trans. 1* **2000**, 471.
- Mandare, P. N.; Pangarkar, V. G. *Chem. Eng. Sci.* **2003**, *58*, 1125.
- Sharifi, A.; Mohesenzadeh, F.; Mojtahedi, M. M.; Saidi, M. R.; Balalaie, S. *Synth. Commun.* **2001**, *31*, 431.
- Baudoin, B.; Ribeill, Y.; Vicker, N. *Synth. Commun.* **1993**, *23*, 2833.
- Bower, J. F.; Martin, C. J.; Rawson, D. J.; Slawin, A. M. Z.; Williams, J. M. J. *J. Chem. Soc., Perkin Trans. 1* **1995**, 333.
- Bhat, S.; Ramesha, A. R.; Chandrasekaran, S. *Synlett* **1995**, 329.
- Bandgar, B. P.; Shaikh, S. I.; Iyer, S. *Synth. Commun.* **1996**, *26*, 1163.
- Kabalka, G. W.; Yu, S.; Li, N.-S. *Tetrahedron Lett.* **1997**, *38*, 7681.
- Jadhav, V. K.; Pal, R. R.; Wadgaonkar, P. P.; Salunkhe, M. M. *Synth. Commun.* **2001**, *31*, 3041.
- Espiritu, M.; Handley, P. N.; Neumann, R. *Adv. Synth. Catal.* **2003**, *345*, 325.
- Bandgar, B. P.; Sadavarte, V. S.; Uppalla, L. S. *Chem. Lett.* **2001**, 894.
- DelwarHossain, Md.; Kitamura, T. *J. Org. Chem.* **2005**, *70*, 6984.
- Bjorsvik, H.-R.; Merinero, J. A. V.; Liguori, L. *Tetrahedron Lett.* **2004**, *45*, 8615.
- Firouzabadi, H.; Iranpoor, N.; Amani, K. *Green Chem.* **2001**, *3*, 131.
- Roche, D.; Prasad, K.; Repic, O.; Blacklock, T. J. *Tetrahedron Lett.* **2000**, *41*, 2083.
- Morrow, N.; Ramsden, C. A.; Sargent, B. J.; Wallett, C. D. *Tetrahedron* **1998**, *54*, 9603.
- Ramsden, C. A.; Sargent, B. J.; Wallett, C. D. *Tetrahedron Lett.* **1996**, *37*, 1901.
- Bandgar, B. P.; Uppalla, L. S.; Sadavarte, V. S.; Patil, S. V. *New J. Chem.* **2002**, *26*, 1273.
- Nongkunsarn, P.; Ramsden, C. A. *Tetrahedron* **1997**, *53*, 3805.