SYNLETT
Spotlight 319

Sodium Triacetoxyborohydride

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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

Sodium triacetoxyborohydride [$\text{Na}(\text{OAc})_3\text{BH}$, abbreviated as STAB-H] is a versatile reagent in organic synthesis. In addition to its superior ability in effecting reductive amination of aldehydes and ketones, it can reduce N-heterocycles (indoles, quinolines, and isoquinolines), imines, enamines, oximes, amides, aryl ketones, acetals, and other substrates.¹

STAB-H is a milder and more selective reducing agent than NaBH_4 . The mild nature of STAB-H may be attributed both to the bulky nature of the reagent and to the inductive electron-withdrawing ability of the three acetoxy

groups which stabilize the boron–hydrogen bond.² It has more advantages over $\text{Na}(\text{CN})\text{BH}_3$ also due to the lack of toxicity.

The preparation of triacetoxyborohydride was first performed by Wartik and Pearson through the reaction of NaBH_4 and CO_2 (Scheme 1).³ Furthermore, it can be also generated in situ from NaBH_4 and acetic acid. Aldehydes, but not ketones, are smoothly reduced to alcohols with STAB-H, prepared from sodium borohydride and acetic acid in benzene⁴ or in *N,N*-dimethylacetamide.⁵

Scheme 1

Abstracts

(A) Boros et al. recently reported the synthesis of diazaindoline **3**, where the key step involved rapid reductive amination of aldehyde **1** with aniline **2** by sodium triacetoxyborohydride (STAB-H) and TFA.⁶

(B) A tandem reductive amination–lactamization strategy using STAB-H, 1-benzyl-4-piperidone (**4**) and γ - or δ -amino esters or acids resulted in lactam **5**.⁷

(C) Dialdehyde **6** can be converted into amine **7** with STAB-H and benzylamine, whereas lactol **8** likewise affords lactam **9** under similar conditions.^{8,9}

(D) As mentioned already, STAB-H is a milder reducing agent than NaBH_4 and hence selective. It can reduce vinylogous carbamate **10** selectively without affecting other functionalities.¹⁰

(E) The reduction of an imine can be effected by STAB-H. The reduced form of the quarter pyrroles **13** can be obtained by using STAB-H from the stable oxidized form **12**.¹¹

(F) It is shown that STAB-H effectively reduced amide **14** to **15** in the total synthesis of a selective D1 antagonist useful in the treatment of psychoses, depression, and D1-dependent neurological disorders.¹²

(G) Cleavage of oxazolidines **16** can easily be carried out with STAB-H¹³ to provide **17** and this tactic was featured in the first enantiospecific synthesis of salinosporamide A.¹⁴

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