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Applications of sodium borohydride procedure for the reductive removal of Evans and other chiral auxiliaries

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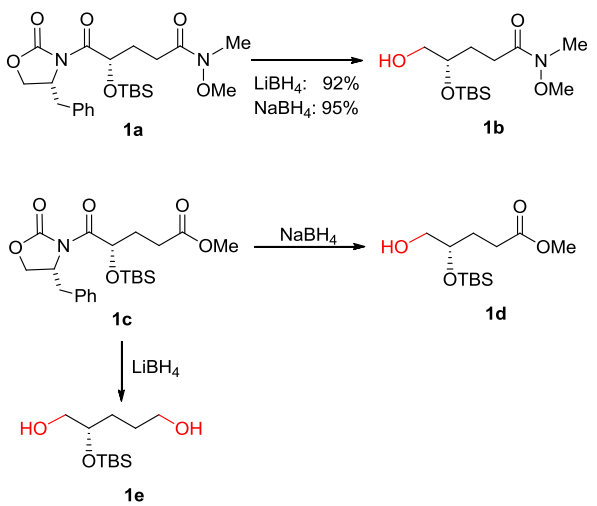
1. Introduction

In early eighties, Evans and his co-workers developed chiral 2-oxazolidinones as efficient auxiliaries for asymmetric synthesis. Since then, it has been demonstrated that employing this class of chiral auxiliary, high diastereoselectivity can be achieved in reactions such as aldol reactions, alkylations, brominations, conjugate additions, cycloadditions, Diels–Alder reactions, hydroxylations, and Michael additions.[1–5]

Several methodologies were developed to remove these auxiliaries, after attaining the desired asymmetric induction, based on the functionalities needed for the subsequent chemical transformations: reduction ($LiAlH_4$, $LiBH_4$, $NaBH_4$) to alcohol, hydrolysis (LiOH, H_2O_2) to carboxylic acid, methanolysis (NaOMe, MeOH) to ester, and transamination (MeONHMe, Me_3Al) to Weinreb amide.[5] For reductive removal of these auxiliaries, $LiAlH_4$ and $LiBH_4$ were developed initially.[6–8] A more economical, practical and racemization-free method for the reductive removal of 2-oxazolidinones with $NaBH_4$ in a mixture of THF and water was later reported by Prashad et al.[9]

Lithium aluminum hydride is useful for molecules containing no functional groups that are vulnerable to reduction, such as esters. Lithium and sodium borohydride have been extensively used. In one study, reductive removal of oxazolidinone auxiliary of **1a** with $LiBH_4$ or $NaBH_4$ gave similar results when compared side by side (Scheme 1).[10] However, reduction of **1c** with $LiBH_4$ led mainly to diol **1e** (both the oxazolidinone and the ester were reduced). In contrast, reductive removal of oxazolidinone auxiliary of **1c** with $NaBH_4$ was chemoselective affording only product **1d**.[10]



Scheme 1.