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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

Diisobutylaluminun Hydride (DIBAL-H)

Compiled by Isabel Fernández-Bachiller

Ma Isabel Fernández-Bachiller studied chemistry at the Universidad Complutense of Madrid (1995–2000), where she was involved in undergraduate research on molecular modelling with Dr. M. J. R. Yunta. She is currently working on her Ph.D. thesis about Alzheimer's disease in the Medicinal Chemistry Institute (CSIC), with Dr. M. I. Rodríguez-Franco.

Instituto de Química Médica (CSIC), Juan de la Cierva, 3, 28006 Madrid, Spain

E-mail: Lab310@iqm.csic.es



Introduction

Among reducing agents, diisobutylaluminun hydride (DIBAL-H) stands out, having been extensively used for a broad variety of reductive transformations in organic chemistry. It is easy to use and reduces many functional groups under mild reaction conditions. Aldehydes, ketones, acids, esters, acid chlorides, amides, nitriles, isocyanates, nitro compounds, and disulfides are examples of suitable substrates, whereas alkyl halides are unreactive towards DIBAL-H. Usually, reactions are strongly solvent and/or temperature dependent and as an example, sulfides, sulfones, and sulfonic acids are unreactive in toluene at 0 °C.2

Along with the reductive capability of DIBAL-H, its Lewis acid properties extend the scope of transformations, and the combination of these two properties has been used in the stereoselective synthesis of valuable products in chemistry, like pharmaceuticals.³

DIBAL-H is commercially available pure or in solution of alkanes, ethers, dichloromethane, toluene, etc.

Precautions: Neat DIBAL-H is a pyrophoric liquid and its solutions react violently with water, oxygen and related compounds. It is necessary to work in a fume hood, using anhydrous solvents, under inert atmosphere (argon or nitrogen).

Abstracts

A) Considerable attention has been paid to the application of DIBAL-H, alone or in the presence of $ZnCl_2$ in asymmetric synthesis for the steroeselective reduction of hydroxyketones, ⁴ aminoketones, ⁵ and β -ketosulfoxides. ⁶ These reactions yield preferably 1,3-syn diols (Table 1), through a six-membered ring complex between the Al or Zn atom and the 1,3-difunctional substrate, whose keto group then undergoes hydride attack at the less sterically hindered face, due to the large volume occupied by DIBAL-H. In general, these reactions are solvent dependent, and the best results have been found in THF.

Table

X	Y	Reagent	2:3	Ref.
C	OH	DIBAL	95:5	(4)
С	NHR	DIBAL/ZnCl ₂	99:1	(5)
S	O	DIBAL/ZnClo	95:5	(6)

B) Sharma et al⁷ have used the Lewis acid character of DIBAL-H to effect Claisen rearrangements, a valuable synthetic tool for the formation of carbon-carbon bonds,⁸ in allyl aryl ethers (4). DIBAL-H was found to be very effective for exclusive migration to give ortho Claisen product (5) under mild reaction conditions, although the formation of compound 6 is also observed in small quantities (13:1), through a hydro-alumination and hydrolysis reactions.

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C) The combination of DIBAL-H/THF in a 1:1 ratio provides an efficient method for iodine transfer cyclizations for the formation of five-membered rings. Different iodoalkynylacetals **7** (X = O, R_2 = OBu) and iodoalkynes **7** (X = CH₂ R_2 = H) are employed, to obtain the corresponding tetrahydrofuran (X = O) or carbocycle (X = CH₂) **8** in good yield (60–90%). The cyclization proceeds by a radical pathway and no trace of the fragmentation of the starting material into the propargylic alcohol or enol ether is observed. In all cases, the two isomers Z, E for the vinyl iodides were obtained.

$$R_1$$

DIBAL: THF (1:1)

hexane, r. t.

 R_1
 R_1
 R_1
 R_2
 R_2
 R_2
 R_2
 R_1
 R_2
 R_2
 R_3
 R_4
 R_4
 R_5
 R_5
 R_5
 R_6
 R_7
 R_8
 R_9
 $R_$

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