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

Diazabicyclo[2.2.2]octane – DABCO

Vembaiyan Kannan obtained his masters degree in chemistry from Bharathidasan University, Tamil Nadu, India in 1997. He is currently working towards his PhD thesis under the supervision of Dr. P. Radha Krishna at the Indian Institute of Chemical Technology, India. His research interests include asymmetric Baylis–Hillman reactions applied to the total synthesis of biologically active natural products and the development of new synthetic methodologies.

D-206, Discovery Laboratory, Organic-III Division, Indian Institute of Chemical Technology, Tarnaka, Hyderabad-500007, India
E-mail: vkan06@yahoo.com

Introduction

Diazabicyclo[2.2.2]octane, DABCO (I), is the most commonly used catalyst in the Baylis–Hillman reaction.1 This important carbon-carbon bond forming reaction has received much attention in recent years because it provides multifunctional molecules with a newly created stereocenter, which are versatile building blocks in organic synthesis.

The generally accepted mechanism is illustrated in Scheme 1 for the DABCO-catalyzed Baylis–Hillman reaction of benzaldehyde with methyl acrylate.

Abstracts

(1) In 1972, Anthony Baylis and Melville Hillman2 described the reaction of an aldehyde with a broad spectrum of activated alkenes under the influence of DABCO (I).

(2) Drewes et al.3 reported the DABCO (I)-catalyzed intramolecular Baylis–Hillman reaction of the acrylate ester of salicylaldehyde to afford a crystalline coumarin salt as the major product being in evidence with the proposed mechanism.
(3) Chiral C$_2$-symmetric 2,3-disubstituted DABCOs$^4$ have been effectively utilized for the asymmetric Baylis–Hillman reaction between $p$-nitrobenzaldehyde and methyl vinyl ketone under high pressure (5–10 kbar) to obtain asymmetric induction up to 47% ee.

(4) Leahy et al.$^5$ described the most impressive asymmetric Baylis–Hillman reaction using Oppolzer’s sultam as chiral auxiliary and DABCO as catalyst to obtain the chiral dioxanone product in high enantiomeric purity (>99% ee). It is noteworthy that the sultam auxiliary was fortuitously cleaved by the addition of a second equivalent of aldehyde.

(5) We have recently reported the DABCO-catalyzed diastereoselective Baylis–Hillman reaction using sugar acrylate$^6$$^7$ as chiral Michael acceptor and sugar aldehyde$^8$ as chiral electrophile to achieve moderate to good diastereoselectivities (5–86% de).

(6) Recently, Hu and co-workers$^9$ have shown that the use of stoichiometric base catalyst I, in an aqueous medium, accelerates the Baylis–Hillman reaction. Moreover, the less reactive Michael acceptor acrylamide,$^{10}$ which normally reacts only under high pressure, also undergoes Baylis–Hillman coupling with reactive electrophiles under these conditions.

(7) The Baylis–Hillman coupling of salicylaldehyde$^{11}$ with various activated alkenes in the presence of I proceeds with regioselective cyclization to afford the corresponding 3-substituted chromone derivatives.

References


