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BAYLIS-HILLMAN REACTION IN ORGANIC CHEMISTRY

Dandamudi V. Lenin*

School of Chemical Sciences, Central University of Gujarat, Gandhinagar, India.

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***Corresponding Author**
Dr. Dandamudi V. Lenin
School of Chemical Sciences, Central University of Gujarat, Gandhinagar, India.

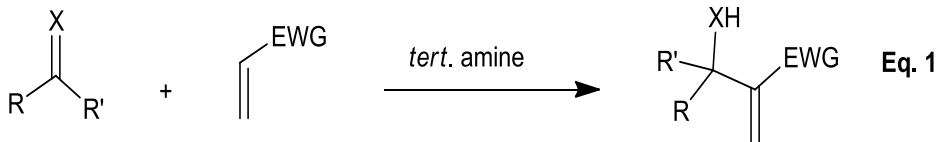
INTRODUCTION

C-C bond formation is one of the most essential reactions in organic synthesis. Several significant C-C bonds forming reactions are known in literature. Example Friedel-Crafts reaction[1], Claisen rearrangements[2], Diels-Alder reaction[3], Grignard reaction[4], Suzuki coupling[5], Wittig reaction[6] *etc.*, Applications for the synthesis of carbocycles, heterocycles, medicinally important compounds and natural products have been well known in literature.

Baylis-Hillman reaction is one such different developing C-C bond forming reaction. It is owning most important requirements like:

- Atom economy
- Selectivity
- Organo-catalytic process.

This reaction first invention in 1972 by A. B. Baylis and M. E. D. Hillman. Baylis-Hillman reaction[7,8] is the coupling of α-position of an activated alkene with an electrophile in the presence of tertiary amine catalyst (Eq. 1).



R = aryl, alkyl, heteroaryl; R' = H, COOR, alkyl
X = O, NCOOR, NTs, NSO_2Ph
EWG = Electron Withdrawing Groups
COR, CHO, CN, COOR, $PO(OEt)_2$, SO_2Ph, SO_3Ph, SOPh

Baylis-Hillman reaction

Essential components

The essential components for the Baylis-Hillman reaction is

- Activated alkene
- Electrophile
- Catalyst.

The most commonly used activated alkenes[9-17] are alkyl vinyl ketones, alkyl/aryl acrylates, acrylonitrile. Other activated alkenes vinyl sulphones, acrylamides, allenic esters, vinyl sulphonates, vinyl phosphonates and acrolein etc. have also been successfully employed in the Baylis-Hillman reaction. Varity of chiral activated alkenes also employed for asymmetric Baylis-Hillman reaction. Aliphatic, aromatic, hetero-aromatic aldehydes are the frequently used electrophiles in this reaction. Other electrophiles[18-22] such as α-keto esters, non-enolizable 1,2-diketones, aldimine derivatives, fluoro ketones, activated alkenes and isatin derivatives etc.. have also been effectively used in this reaction. Chiral electrophiles[23-28] such as (*S*)-*O*-protected lactaldehyde, α-dialkylamino and α-(*N*-acylamino) aldehyde, *N*-phenylsulfonyl-(*L*)-prolinal, (*R*)-myrtenal, isopropylidene (*R*)-glyceraldehyde etc.. were successfully employed for this asymmetric version. DABCO is the commonly used catalyst for this reaction, various other tertiary amine catalysts such as DBU, DMAP, aq. Me_3N and methanolic-Me_3N etc. Many non-amine catalysts such as trialkyl phosphines, triaryl phosphines, R_2S-$TiCl_4$, R_2S-BF_3, $TiCl_4$-NR_4X (X = halide), $TiCl_4$-NR_3, $TiCl_4$ and Et_2AlI were also successfully employed as catalysts/catalytic systems in Baylis-Hillman-type coupling.

APPLICATIONS

Presence of many fictional groups in proximity the Baylis-Hillman adducts (Fig. 1) have become significant substrates[29,30] for a number of name and un-named reactions like Friedel-Crafts reaction, Diels-Alder reaction, Heck reaction, Claisen rearrangements, isomerization, hydrogenation and photochemical reactions *etc.* These adducts have also been elegantly employed as valuable synthons in the synthesis of important and hetero/carbocycles and natural products, biologically active molecules.

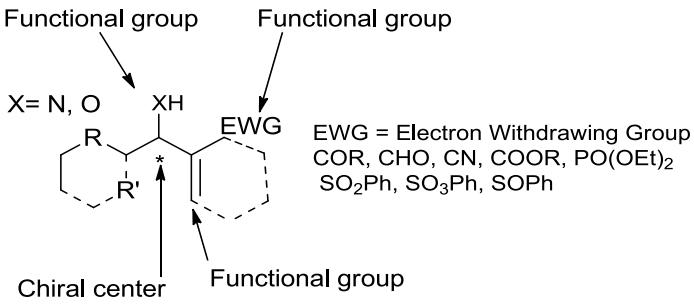


Fig. 1 Baylis-Hillman Adduct

REFERENCES

1. Friedel-Crafts Chemistry; Olah, G. A., Ed; New York: Wiley, 1973.
2. Ziegler, F. E. Chem. Rev., 1988; 88: 1423.
3. Oppolzer, W. Angew. Chem. Int. Ed. Engl., 1984; 23: 876.
4. Walborsky, H. M. Acc. Chem. Res., 1990; 23: 286.
5. Miyaura, N.; Suzuki, A. Chem. Rev., 1995; 95: 2457.
6. Maryanoff, B. E.; Rietz, A. B. Chem. Rev., 1989; 89: 863.
7. Baylis, A. B.; Hillman, M. E. D. German patent 1972; 2155113.
8. Chem. Abstr., 1972; 77: 34174.
9. Fort, Y.; Berthe, M. C.; Caubere, P. Tetrahedron, 1992; 48: 6371.
10. Basavaiah, D.; Gowriswari, V. V. L. Tetrahedron Lett., 1986; 27: 2031.
11. Amri, H.; Villieras, J. Tetrahedron Lett., 1986; 27: 4307,
12. Auvray, P.; Knochel, P.; Normant, J. F. Tetrahedron Lett., 1986; 27: 5095.
13. Kundu, M. K.; Mukherjee, S. B.; Balu, N.; Padmakumar, R.; Bhat, S. V. Synlett, 1994; 444.
14. Tsuboi, S.; Takatsuka, S.; Utaka, M. Chem. Lett., 1988; 2003.
15. Wang, S.-Z., Yamamoto, K.; Yamada, H.; Takahashi, T. Tetrahedron, 1992; 48: 2333.
16. Amri, H.; El Gaied, M. M.; Villieras, J. Synth. Commun., 1990; 20: 659.
17. Hill, J. S.; Isaacs, N. S. Tetrahedron Lett., 1986; 27: 5007.
18. Grundke, C.; Hoffmann H. M. R. Chem. Ber., 1987; 120: 1461.
19. Perlmutter, P.; Toe, C. C. Tetrahedron Lett., 1984; 25: 5951.
20. Golubev, A. S.; Galakhov, M. V.; Kolomiets, A. F.; Fokin, A. V. Bull. Rus. Acad. Sci., 1992; 41: 2193.
21. Basavaiah, D.; Gowriswari, V. V. L.; Bharathi, T. K. Tetrahedron Lett., 1987; 28: 4591.
22. Garden, S. J.; Skakle, J. M. S. Tetrahedron Lett., 2002; 43: 1969.

23. Drewes, S. E.; Manickum, T.; Roos, G. H. P. Synth. Commun., 1988; 18: 1065.
24. Kundig, E. P.; Xu, L. H.; Romanens, P.; Bernardinelli, G. Tetrahedron Lett., 199; 34: 7049.
25. Kundig, E. P.; Xu, L. H.; Schnell, B. Synlett, 1994; 413.
26. Drewes, S. E.; Njamela, O. L.; Roos, G. H. P. Chem. Ber., 1990; 123: 2455.
27. Drewes, S. E.; Khan, A. A.; Rowland, K. Synth. Commun., 1993; 23: 183.
28. Manickum, T.; Roos, G. H. P. Synth. Commun. 1991, 21, 2269; S. Afr. J. Chem., 1994; 47: 1.
29. Basavaiah, D, Jaganmohan Rao, A, Satyanarayana, T Chem. Rev., 2003; 103: 811.
30. Basavaiah, D, Reddy, S. R, Badsara S Chem. Rev., 2010; 110: 5447–5674.