



# Baylis-Hillman Reaction in Organic Chemistry

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**Abstract**—The Baylis–Hillman reaction is a novel carbon-carbon bond forming reaction between  $\alpha$ -position of activated alkene and carbon electrophile under catalytic influence of a tertiary amine. It produces a multifunctional molecule usually known as Baylis-Hillman adducts. This review highlights how the Baylis-Hillman reaction developed and importance of this reaction in organic chemistry.

**Keywords**—Carbon-carbon bond forming reaction, electrophile, asymmetric reaction, atom economy.

## INTRODUCTION

Baylis-Hillman reaction<sup>1</sup> is an important carbon-carbon bond forming reaction in organic chemistry. It is essentially a three-component atom economic reaction between activated alkene and carbon electrophile under influence of catalytic system (Fig. 1). In recent years this reaction developed in all three essential components i.e. activated alkene, carbon electrophile and catalytic systems. There are large number of publications evidenced the development and importance of this reaction.

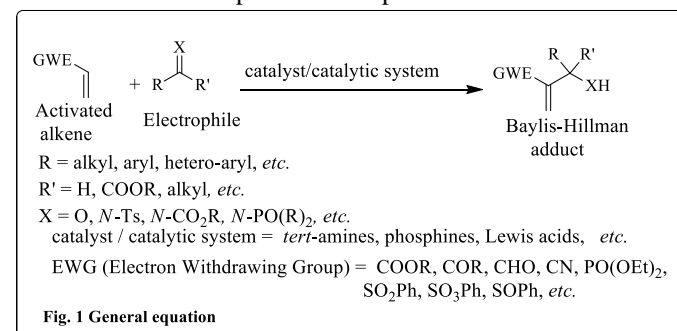


Fig. 1 General equation

## ORIGIN OF THE REACTION

The Baylis-Hillman reaction originally invented by two American chemists A. B. Baylis and M. E. D. Hillman. On this reaction German patent<sup>2</sup> filed in the year 1972 and U.S patent<sup>3</sup> in the year 1973.

## ESSENTIAL COMPOUNDS

During the three decades Baylis-Hillman reaction has developed with respect to all the three essential compounds i.e. a) Electrophiles b) Activated alkenes and c) Catalysts or catalytic systems. Several acyclic and cyclic activated

alkenes<sup>4</sup> have been successfully employed for coupling with various electrophiles to provide multifunctional Baylis-Hillman adducts. A variety of electrophiles<sup>5</sup> have been employed for formation multifunctional molecules usually called as Baylis-Hillman adduct *via* a coupling of activated alkenes. Numerous tertiary amine catalysts/catalytic systems and non-amine catalysts/catalytic systems<sup>6</sup> have been effectively working for this Baylis-Hillman reaction.

## ASSYMETRIC REACTION

Quite a few of chiral acrylates and acrylamides<sup>7</sup> have been active for reaction with electrophiles to provide low to high diastereoselective Baylis-Hillman adduct under the influence of catalyst of catalytic system. Many chiral electrophiles<sup>8</sup> developed for this reaction with activated alkenes under the influence of catalytic systems to provide the multifunctional Baylis-Hillman adducts in diastereoselectivities. For asymmetric version of Baylis-Hillman reaction various chiral amine catalysts<sup>9</sup> studied for to obtain in high diastereoselectivities.

## INTRAMOLECULAR BAYLIS-HILLMAN REACTION

Intramolecular version for Baylis-Hillman reaction<sup>10</sup> can possible if the substrates contain the essential activated alkene and electrophile in the same substrate. During the last several years this aspect has established significant developments from synthetic chemists.

## RATE ACCELERATION OF BAYLIS-HILLMAN REACTION

The Baylis–Hillman reaction is a slow reaction which requires a few days to a few weeks for completion. To overcome this problem with respect to all the three essential components electrophiles, activated alkene and catalytic source, a numerous effort has been made by the organic chemists. Use of excess catalyst, concept of hydrogen bonding, aqueous medium, microwave irradiation, reactive activated alkenes, reactive electrophiles and high pressures have been examined for accelerating this reaction and considerable success has been achieved in this direction. In addition to the above efforts, recently organic chemists have employed some interesting and innovative strategies for rate acceleration<sup>11</sup> in the Baylis–Hillman reaction



## APPLICATIONS OF BAYLIS-Hillman REACTION

Baylis-Hillman adducts contains various fictional groups which is easy to alter into an important substrate. These adducts have also been employed as key synthons in the synthesis of important hetero/carbocycles.<sup>12</sup>

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