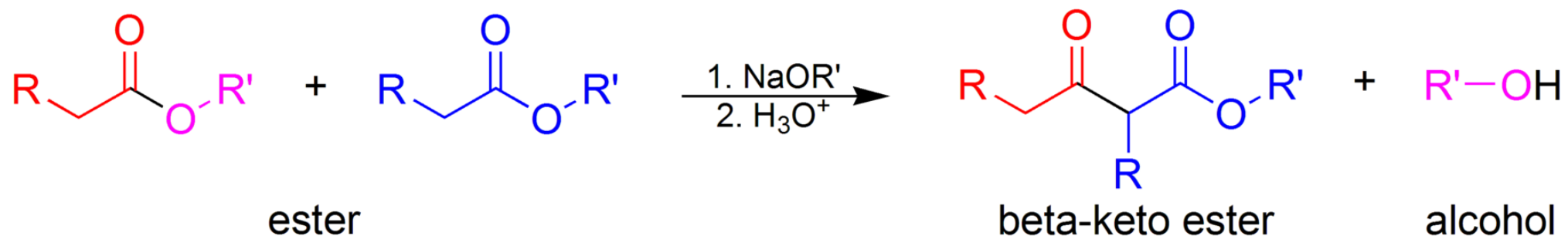


Claisen Ester Condensation

The Claisen condensation is a carbon–carbon bond forming reaction that occurs between two esters or one ester and another carbonyl compound in the presence of a strong base, resulting in a β -keto ester or a β -diketone.



Requirements

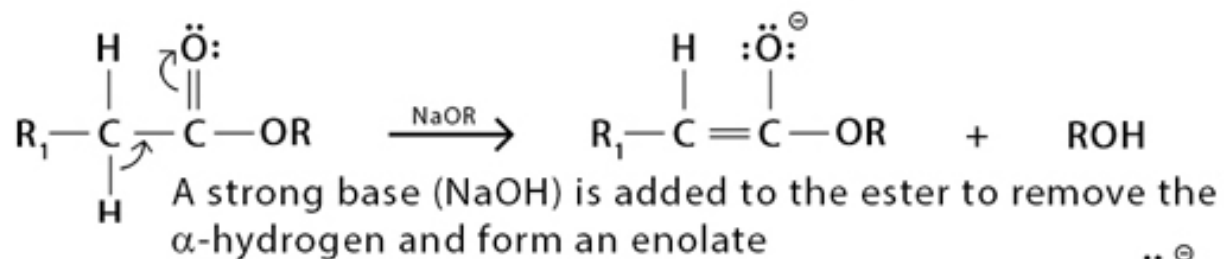
- ❖ At least one of the reagents must be enolizable (have an α -proton and be able to undergo deprotonation to form the enolate anion).
- ❖ There are a number of different combinations of enolizable and nonenolizable carbonyl compounds that form a few different types of Claisen.
- ❖ The base used must not interfere with the reaction by undergoing nucleophilic substitution or addition with a carbonyl carbon.

Mechanism

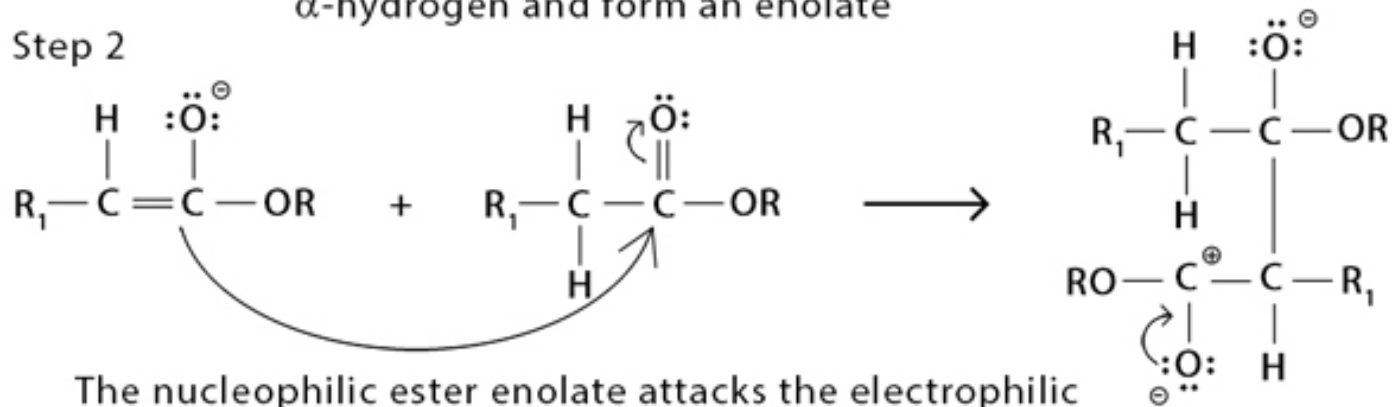
- ❖ In the first step of the mechanism, an α -proton is removed by a strong base, resulting in the formation of an enolate anion, which is made relatively stable by the delocalization of electrons.
- ❖ Next, the carbonyl carbon of the (other) ester is nucleophilically attacked by the enolate anion.
- ❖ The alkoxy group is then eliminated (resulting in (re)generation of the alkoxide), and the alkoxide removes the newly formed doubly α -proton to form a new, highly resonance-stabilized enolate anion.
- ❖ Aqueous acid (e.g. sulfuric acid or phosphoric acid) is added in the final step to neutralize the enolate and any base still present.
- ❖ The newly formed β -keto ester or β -diketone is then isolated.
- ❖ Note that the reaction requires a stoichiometric amount of base as the removal of the doubly α -proton thermodynamically drives the otherwise endergonic reaction.
- ❖ That is, Claisen condensation does not work with substrates having only one α -hydrogen because of the driving force effect of deprotonation of the β -keto ester in the last step.

Mechanism of Claisen Condensation Reaction

Step 1



Step 2



Step 3

