Claisen condensation, not to be confused with Claisen rearrangement, is the reaction of an enolizable ester with a strong base to give a β-ketoester.

\[
\text{enolizable ester} \xrightarrow{\text{strong base (1 eq.)}} \beta\text{-ketoester}
\]

The most commonly used strong base in organic reactions, hydroxide ion, is not suitable for Claisen condensation because it could cause saponification of the ester. The base of choice in Claisen condensation is the alkoxide ion corresponding to the alkoxy group in the ester. Other alkoxides could cause transesterification of the ester. Since the β-ketoester formed in Claisen condensation is converted to the corresponding enolate ion by the base, in order to isolate the β-ketoester, when the reaction is complete, the reaction mixture needs to be acidified.

eg:

\[
\begin{align*}
2 \text{CH}_3\text{CO}_2\text{Et} & \xrightarrow{1. \text{EtO}^- \text{Na}^+ (1 \text{ eq.})} \text{CH}_3\text{C}^-\text{CH}_2\text{CO}_2\text{Et} \quad \text{solvent: EtOH} \\
& \quad \xrightarrow{2. \text{aq. HCl}} \text{CH}_3\text{C}^-\text{CH}_2\text{CO}_2\text{Et} + \text{EtOH}
\end{align*}
\]

**Mechanism**

Step 1: The alkoxide ion deprotonates the enolizable ester reversibly.

Step 2 and 3: Enolate ion 1 undergoes a nucleophilic acyl substitution with the unreacted ester to give the β-ketoester.

Step 4: The alkoxide ion deprotonates the β-ketoester irreversibly.
Step 5: The acid protonates enolate ion 2.

see also Dieckmann condensation

Contributors

- Gamini Gunawardena from the OChemPal site (Utah Valley University)