

Condensation Reaction

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Selective Organic Name Reaction

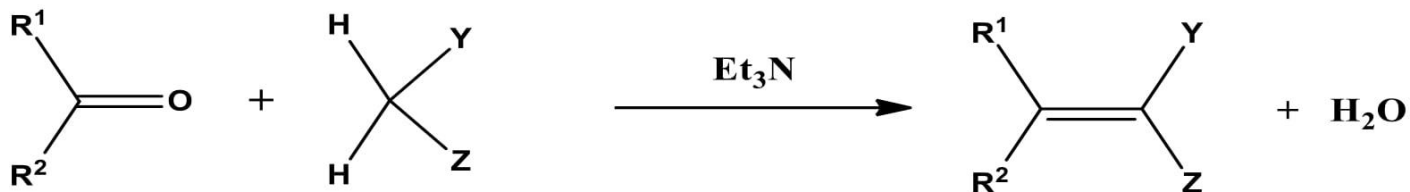
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CONDENSATION

- **KNOEVENAGEL CONDENSATION**

KNOEVENAGEL CONDENSATION

- The reaction of carbonyl compounds with active methylene compounds in the presence of a weak base to afford α,β -unsaturated dicarbonyl or related compounds is known as Knoevenagel condensation.
- Active methylene compounds may be diethyl malonate (DEM), ethyl acetoacetate (EAA), acetylacetone, cyano acetic ester, etc.
- The catalyst is usually a weakly basic amine, an organic base, such as Et_3N , pyridine, piperidine, etc.



Y and Z are electron withdrawing groups

α,β -unsaturated compound

Y, Z = $-\text{CO}_2\text{Et}$; DEM

Y/Z = $-\text{COCH}_3$; Z/Y = $-\text{CO}_2\text{Et}$; EAA

Y, Z = $-\text{COCH}_3$ Acetyl acetone

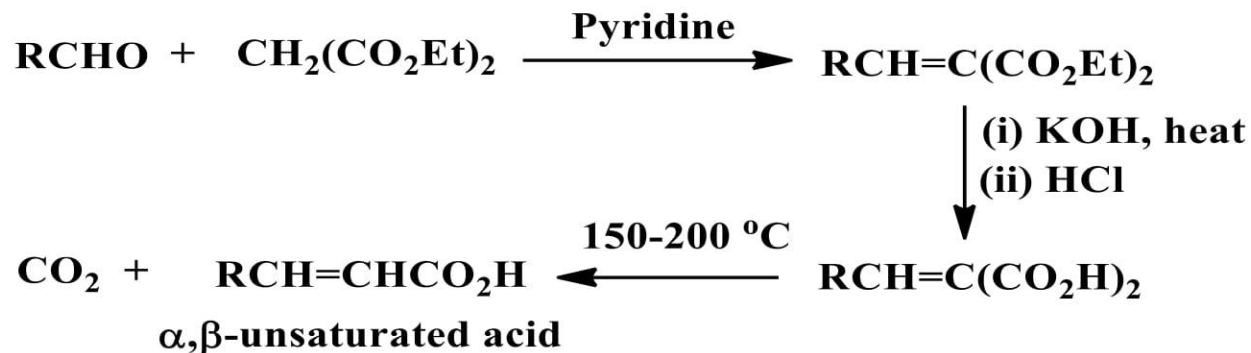
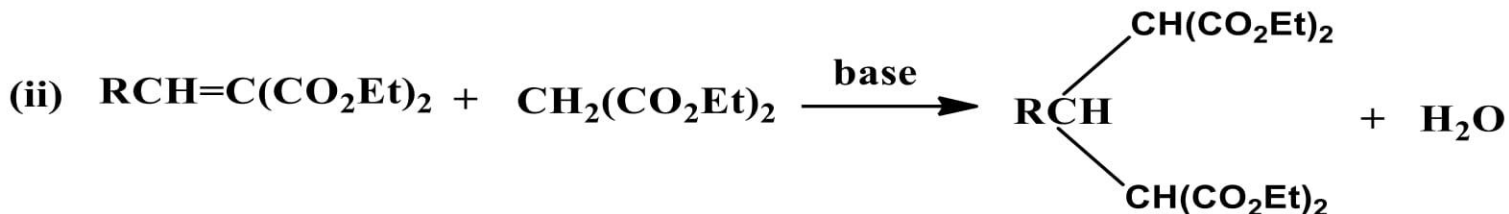
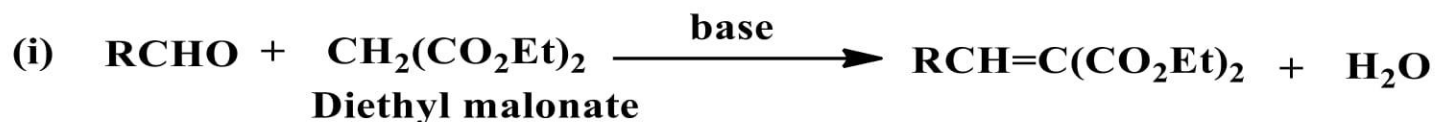
Y/Z = $-\text{CN}$; Z/Y = $-\text{CO}_2\text{Et}$, ethyl cyanoacetate

GENERAL FEATURES

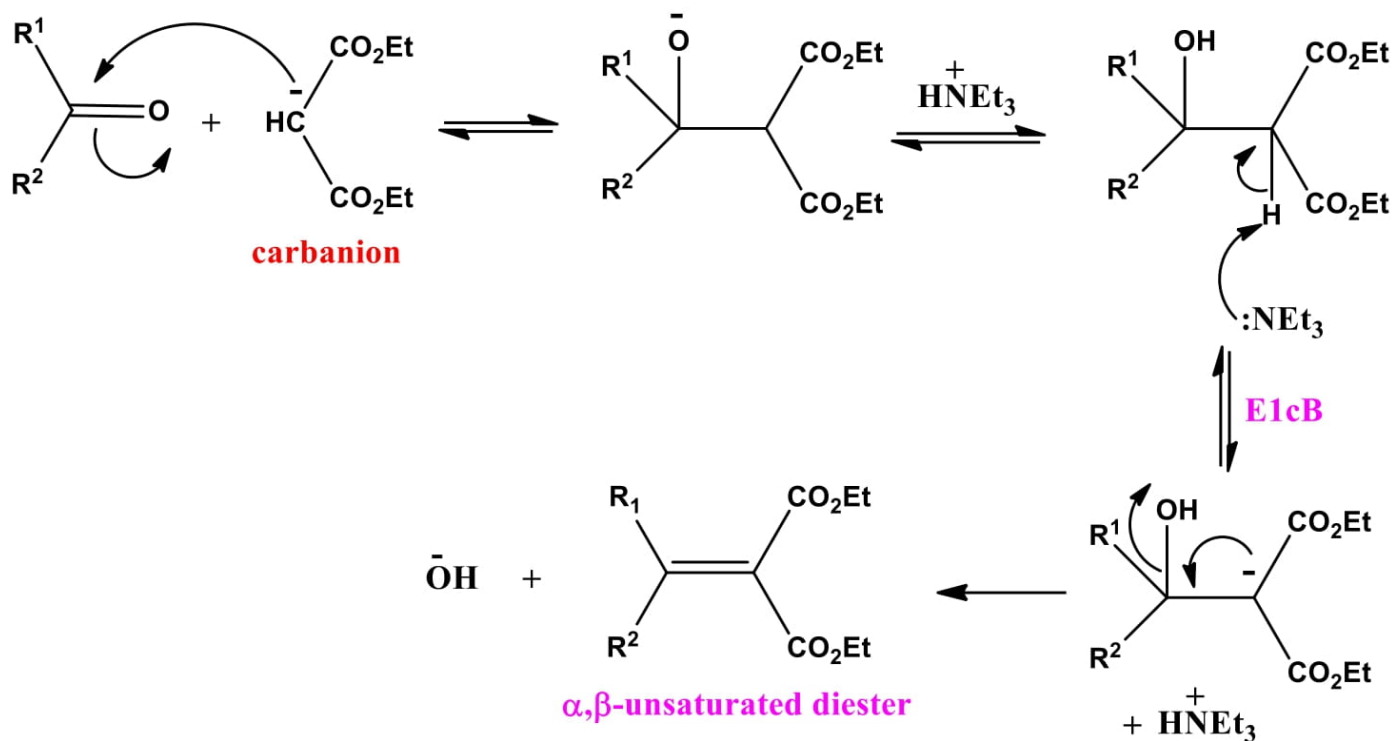
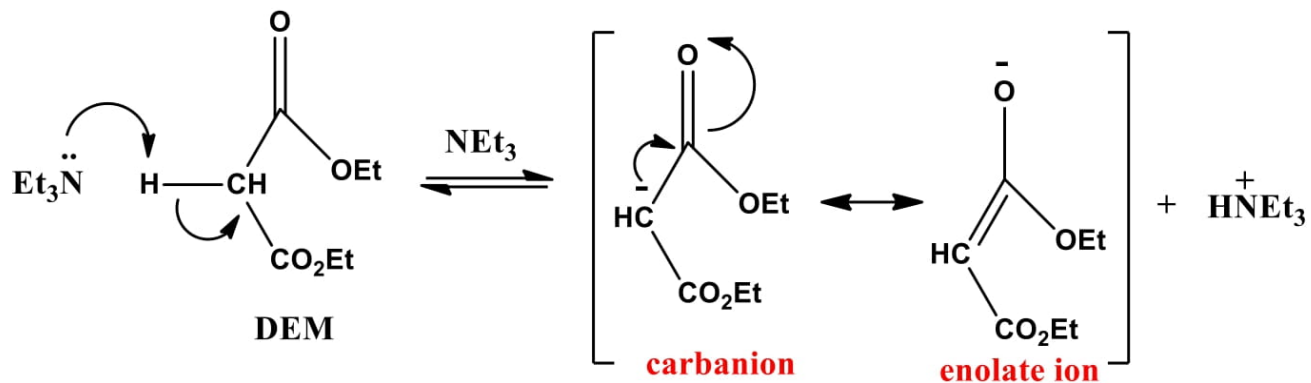
- The Knoevenagel condensation is a base-catalysed aldol type reaction and a general method for preparing α,β -unsaturated acid.
- Aldehydes react much faster than ketones.
- Excess of active methylene compounds must be avoided because that may lead to the formation of Michael addition compound.
- The reaction is all step reversible process and the water produced in the reaction is removed by means of azeotropic distillation to shift the equilibrium to the product side.
- The *gem* diesters on hydrolysis followed by heating gives α,β -unsaturated acids.
- Use of dipolar aprotic solvents (e.g., DMF) is advantageous.

SIDE REACTION

The reaction may stop at stage (i) or proceed to stage (ii) via a Michael condensation involving the initial product. **Reaction (i) is favoured by using equivalent amounts of aldehyde and diethyl malonate in the presence of pyridine. Reaction (ii) is favoured by using excess of diethyl malonate in the presence of piperidine and when the aldehyde is aliphatic.**



MECHANISM



**Thank
You**

