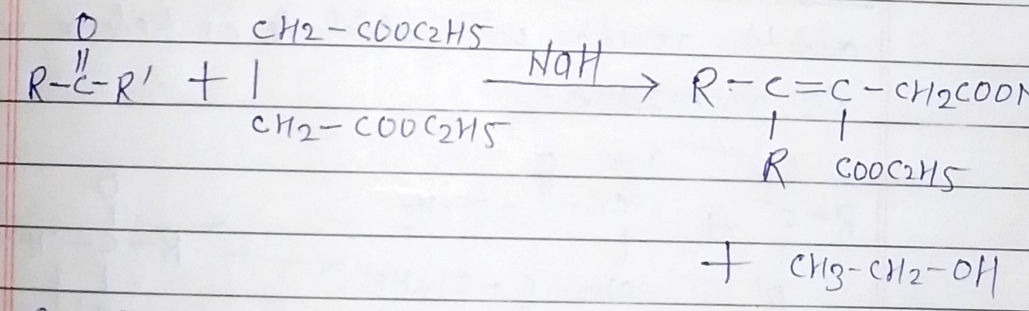
class - P.G. Sem. II
subject - chemistry
Paper - C-C - VIII
unit - I
Dr. Rashmi Sinha
Deptt. of chemistry, H.D.J.C. Ara

Stobbe Reaction

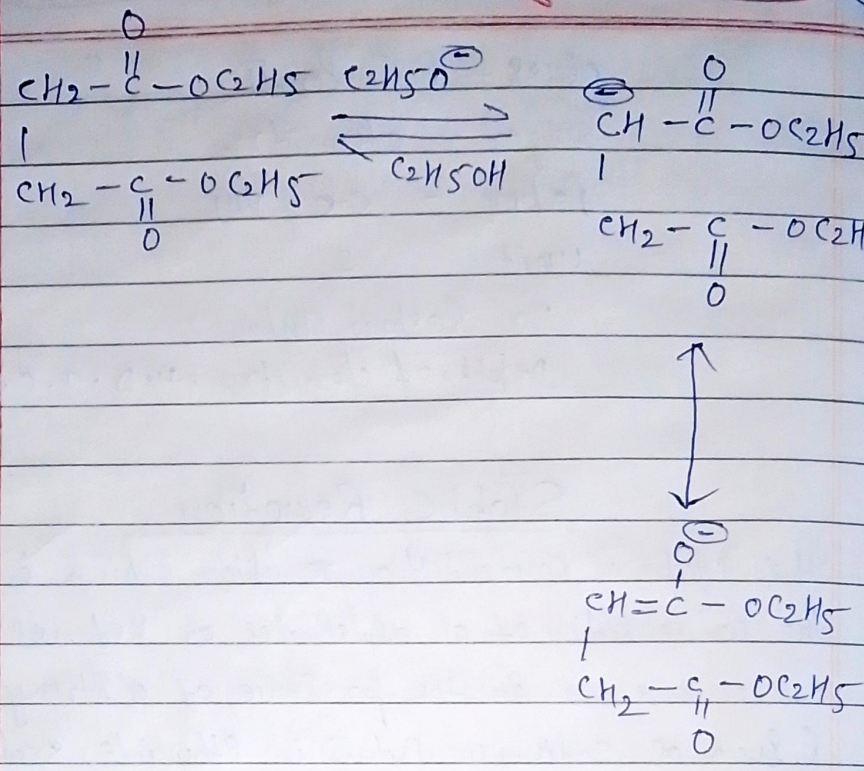
It is a type of condensation reaction which involves the condensation of an aldehydes or ketones with succinic ester in the presence of a strong base (such as sodium or potassium ethoxide, sodium hydride and sodium tert butoxide), to yield monoester of an alpha alkylidene or arylidene succinic acid.



R, R' may be H, alkyl or aryl.

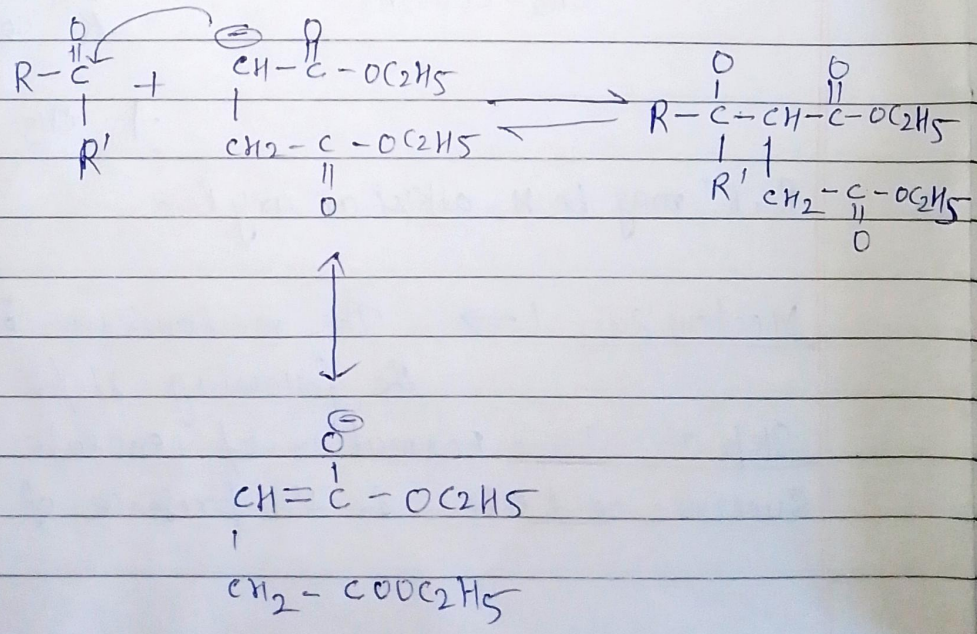
Mechanism :→ The mechanism involves the following steps :—

Step I :— Formation of enolate of succinic acid ester in the presence of a base.

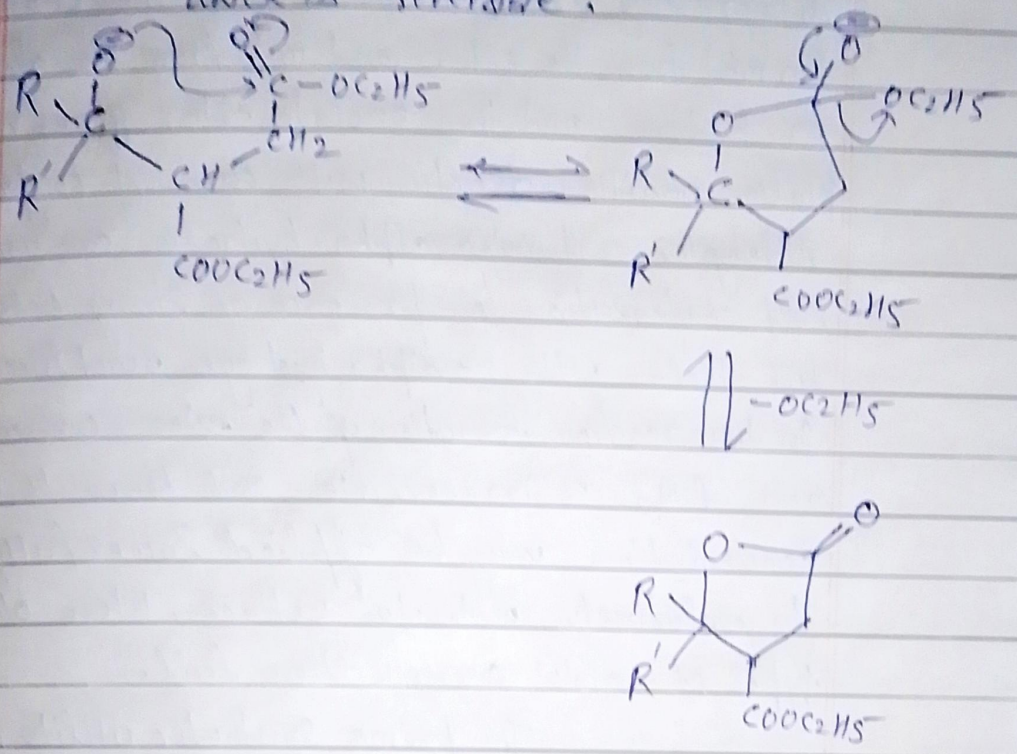


Enolate ion of Succinic-acid ester

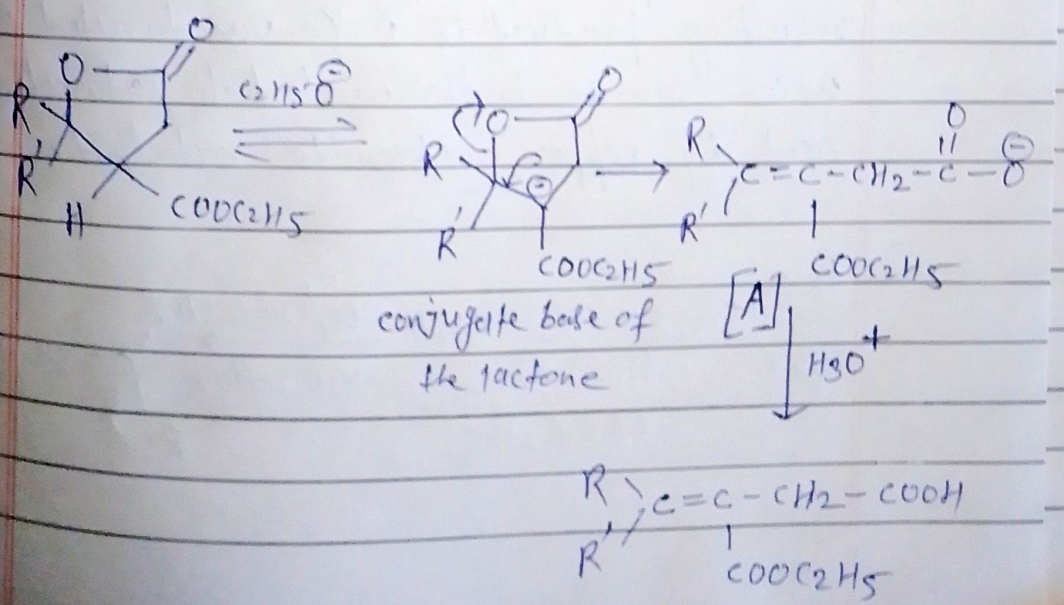
<u>Step II</u> :- Enolate ion gives nucleophilic-addition reaction with aldehyde or Ketone which is reversible.



Step iii :- The resulting adduct cyclises to γ-lactone which is reversible.

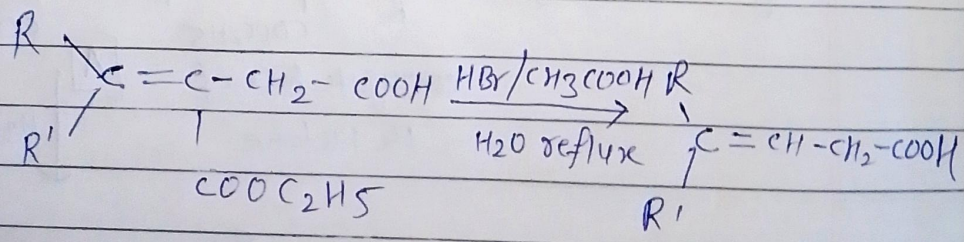


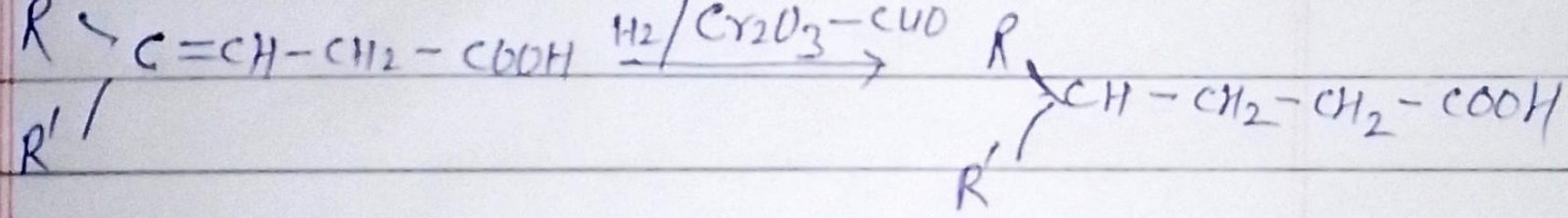
Step iv :- Irreversible ring-opening of the conjugate base of the lactone-ester to give the anion of the unsaturated ester-acid.



In this reaction dialkyl succinate behaves differently from other esters. The enolate formed from the ester and not from the aldehyde or ketone and then enolate ester gives nucleophilic addition reaction with carbonyl compounds. Aldehydes containing alpha-hydrogen can undergoes self condensation in presence of strong base, but those with no alpha-hydrogen react successfully. In this reaction formation of the ester-carboxylate-ion [A] is irreversible and hence this condensation may be applied successfully even to relatively obstructed ketones, where other types of aldol condensation fail.

The prime synthetic utility of the Stobbe condensation arises from the fact that the final condensation product i.e. unsaturated acid ester, may be decarboxylated with HBr in presence of acetic acid and the resulting product is β,γ- unsaturated acid which can be hydrogenated to saturated acid by copper-chromite catalyst.




R
R'
C=CH-CH2-COOH
H2/Cr2O3-CuO
R
R'
CH-CH2-CH2-COOH