Symmetry, Stereochemistry And Application
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Lecture No-48
Name Reactions and their Mechanism - Part 04

Welcome back to the course entitled symmetry stereochemistry and applications. In the last lecture we were talking about Aldol condensation reaction and we have discussed about the reaction mechanisms of Aldol condensation. So, now we will discuss a similar reaction which is called the Claisen Ester condensation reaction.

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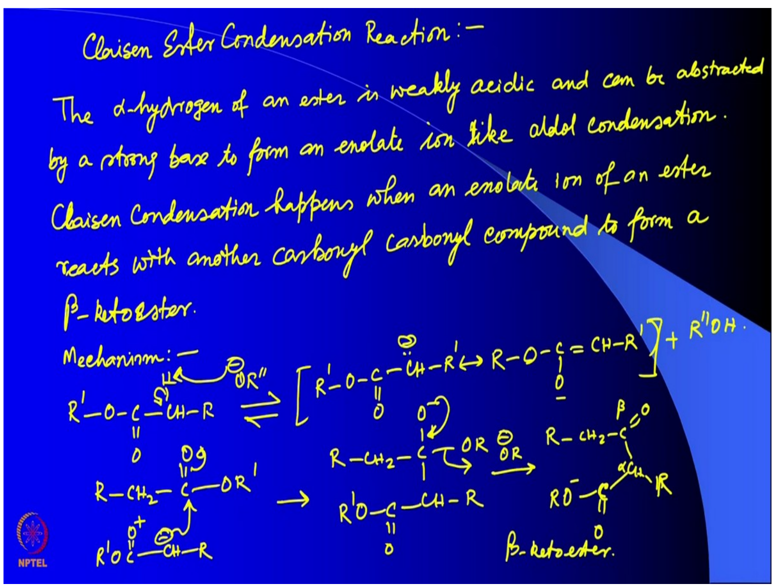

So, here also we need an alpha hydrogen for initiation of the reaction. So, in this Claisen Ester condensation reaction the alpha hydrogen of an ester is weakly acidic and can be abstracted by a strong base to form an enolate ion just like Aldol condensation. This Claisen condensation happens when an enolate ion of an ester reacts with another carbonyl compound to form a beta keto ester.

So, you can understand the mechanism of this reaction is very similar to the Aldol condensation. So, in this case we have an ester ROC double bond OCH2 are and this reacts with an a strong base which abstracts the proton and forms the enolate ion just like Aldol condensation which also has a resonating structure which I am drawing here. Enolate ion reacts with another molecule of ester just like that happened in your Aldol condensation.

So, this enolate ion then reacts with another molecule of ester to form this reaction intermediate and then when this anion again forms back the corresponding C double bond O this OR is eliminated as alkoxide ion and the double bond is formed back. So, now what we have is with respect to this carbonyl carbon this one is alpha and that is beta. So, the product is a beta keto ester. So, this is the product of a standard Claisen condensation reaction.

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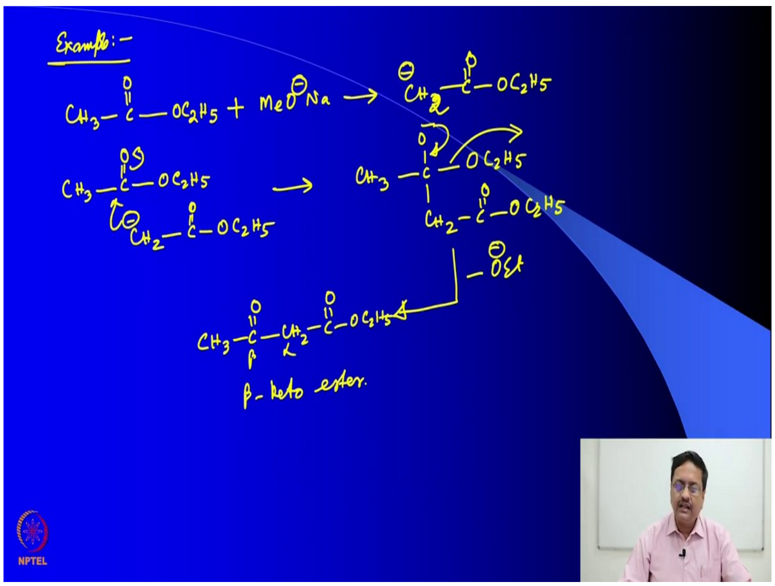

So, let us try to see with another example this ethyl acetate is treated with sodium methoxide to form the carbonanion like this and then this carbonanion further reacts with another molecule of this sodium methoxide, this carbonanion reacts with another molecule of ethyl acetate to form this reaction intermediate and eventually this double bond forms back and the ethoxide ion is released as anion and the product that we get is this one.

So, this is alpha that is beta. So, it is the product beta keto ester. So, the same or similar reaction can be done in a crossed manner that means you can choose 2 different carbonyl compounds and we can choose a carbonyl compound which does not have alpha hydrogen atom.

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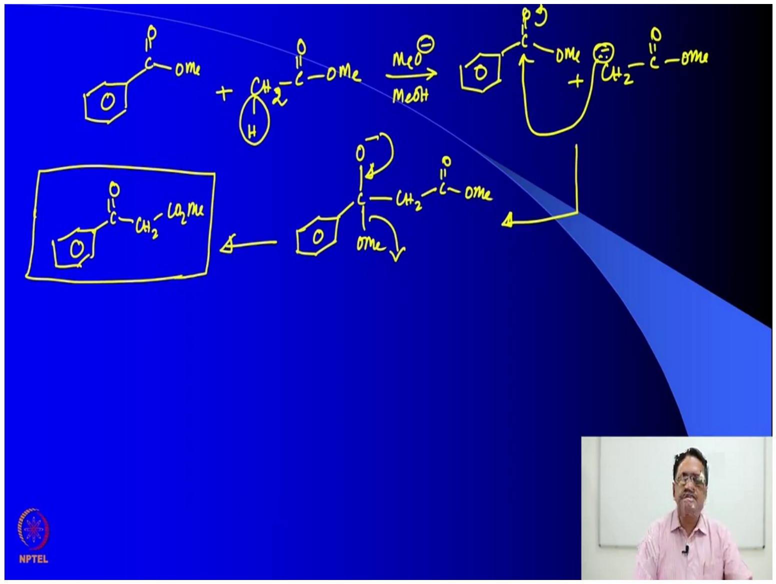

So, just like the previous case of Aldol condensation. So, if we take the ester of benzoic acid and treat this with CH3COOMe that is methyl acetate in the basic medium what will happen is this proton will be abstracted and the anion will be formed. And then this anion will react with the carbonyl carbon of the methyl benzoite and will form this intermediate and then when this double bond forms back OMe is further eliminated and you get the unique product a beta keto ester in this Claisen condensation reaction.

So, one can use Claisen condensation also in a crossed manner just like Aldol, cross Aldol condensation to arrive at a specific organic compound in a very efficient manner. So, there are certain variations of this claisen condensation reaction.

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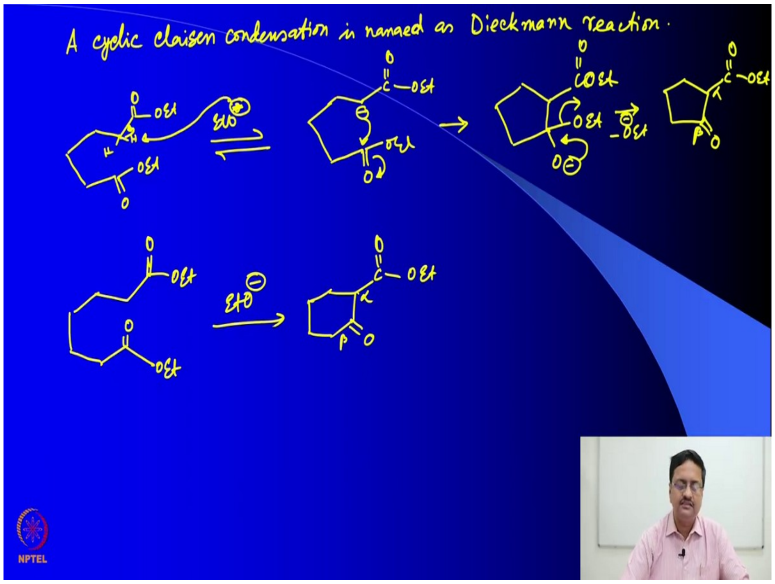

So, when you try to do Claisen condensation reaction in a cyclic manner that is a cyclization reaction through Claisen condensation then it is called a Dieckmann reaction. So, what we call is a cyclic Claisen condensation is named as Dieckmann reaction. So, here you see in a particular compound if you have 2 ester groups at 2 ends. So, when you treat this with EtO minus it can abstract a proton from here and form this compound.

And this enolate can attack the other carbonyl carbon of this same compound at the other end and form a cyclic compound like this then again when this double bond forms OEt is eliminated and you get a cyclic beta keto ester. So, similarly if we do this reaction on a long chain molecule you can form a 6 membered ring very efficiently containing both keto and ester functionality. So, this cyclic Claisen condensation reaction is also very much useful in synthesizing cyclic compounds using the same reaction mechanism.

So, the ester groups are essential at 2 ends once you should have ester group and then this reaction can proceed efficiently.

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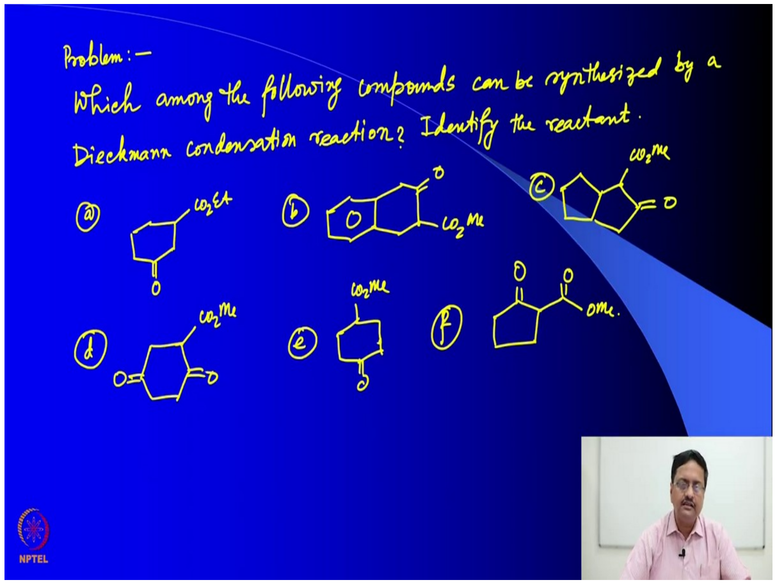

Now I am giving you a problem for you to work out which among the following compounds can be synthesized by a Deickmann condensation reaction identify the reactant. So, I am giving you six compounds. So, this is your homework and you should find out which compounds among the following among these 6 compounds can be made using the Dieckmann condensation reaction.

And identify the starting material or the reactant to make these Dieckmann products. So, we will continue in the next lecture and try to understand a few new reactions in the 11th week, thank you.