

ETHYL ACETO ACETATE

Project work submitted to

Vikrama Simhapuri University, Nellore

In partial fulfillment for the award of the degree of

Bachelor of science in

Chemistry

By,

Y. Revathi

Research supervisor

Smt B Krupa Karuna Vani, Lecturer in Chemistry



DEPARTMENT OF CHEMISTRY

SKR GOVERNMENT DEGREE COLLEGE, GUDUR-524101,

TIRUPATI (Dist.), ANDHRA PRADESH, INDIA.

DECLARATION

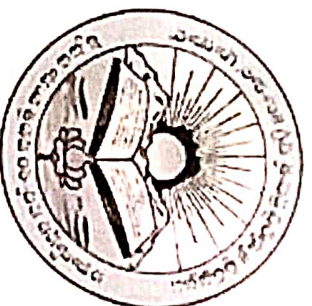
I, **Y.Revathi**, B.Sc. (Second year),
Department of Chemistry SKR Government Degree College,
Gudur, A.P, do hereby declare that Project work entitled **ETHYL
ACETO ACETATE** is carried by me under the guidance of Smt B
Krupa Karuna Vani, lecturer in Chemistry, SKR College, Gudur, A.P.
This work is original and has not been submitted for any other
degree or diploma.

Place: *Gudur*

Date :

Y.Revathi

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CERTIFICATE

This is to certify that the project work entitled **ETHYL ACETO ACETATE** submitted to **Vikrama Simphapuri university** is bonfire record of research work carried out by **Y.REVATHI** for the award of **B.Sc., degree** in record of original research work done by him during the period of his study 2021-2022 under my supervision in the Department of Chemistry **SKR government degree college, Gudur** and has not been submitted in part or full for award of any degree/diploma /associate ship /fellowship /any other similar title.

Place : Gudur
Date :

B Krupa
{BKK Vani}
Research Supervisor

REFERENCES

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Ethyl acetoacetate ($\text{CH}_3\text{COCH}_2\text{COOC}_2\text{H}_5$)

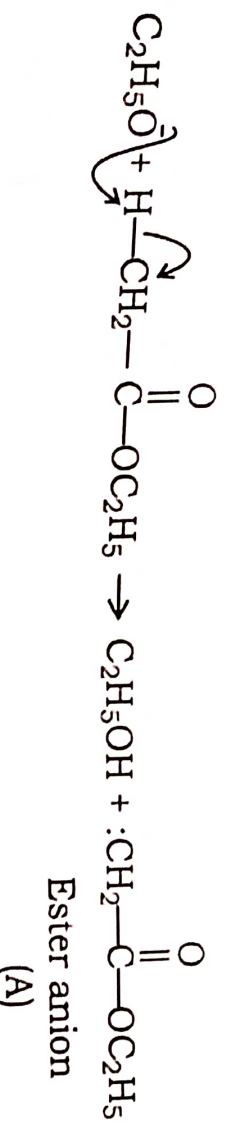
- It is the ethyl ester of acetoacetic acid and hence its name Ethyl acetoacetate.
- Its IUPAC name is 3-oxobutanoate.

Preparation: Ethyl acetoacetate is prepared by refluxing ethyl acetate in presence of sodium ethoxide ($\text{C}_2\text{H}_5\text{ONa}$) in ethanol, followed by acidification.

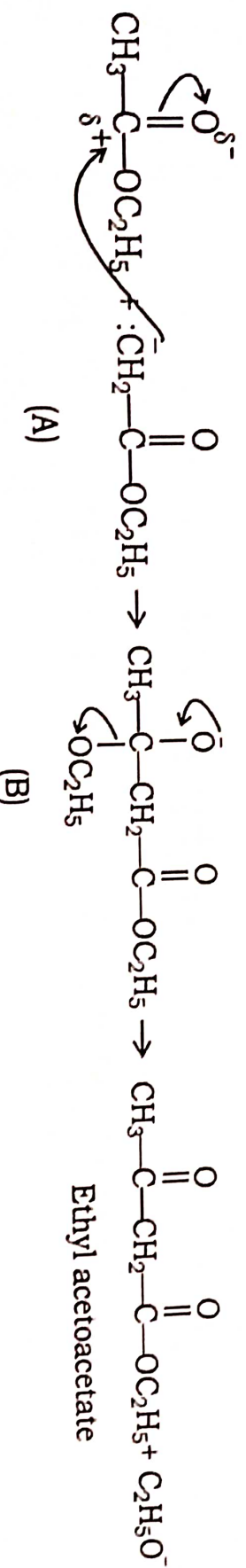


Mechanism: The above reaction, often referred to as *Claisen condensation*, occurs by the following steps.

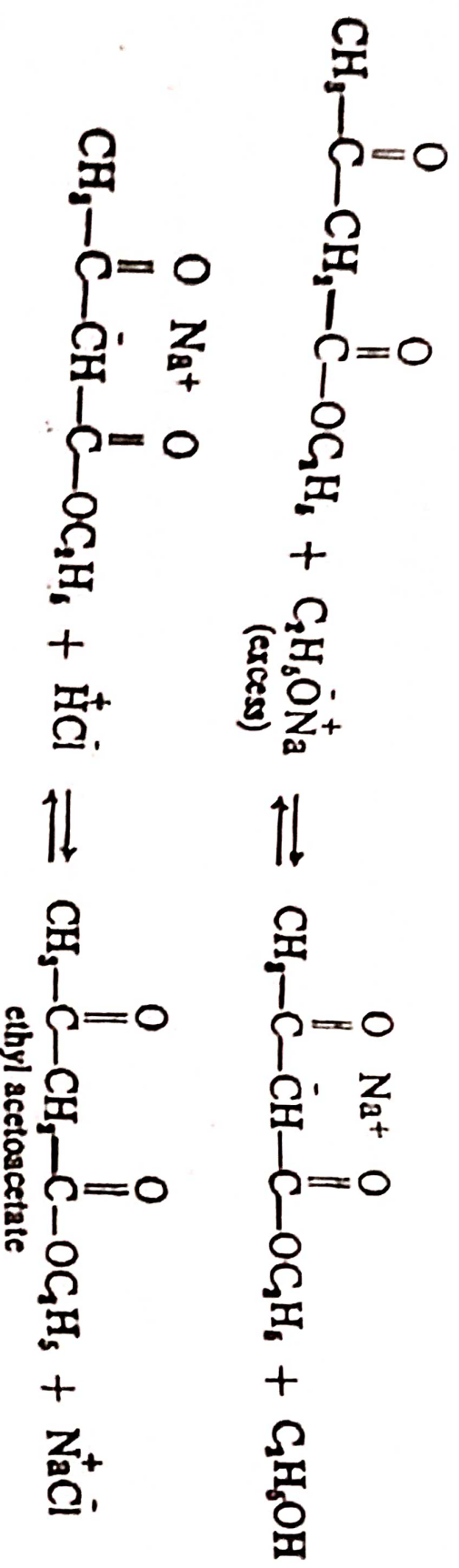
Step-I :- The hydrogen atoms of methyl group of an ethyl acetate molecule are weakly acid because of the adjacent electron-withdrawing ester group. Therefore they form the corresponding ester anion (I) in presence of strongly basic ethoxide ions.



Step -II : The nucleophilic attack of the ester anion (A) takes place on the carbonyl group of second molecule of ethyl acetate. The intermediate which formed eliminates ethoxide ion to produce ethyl acetoacetate



Step-III: Since the three reactions described above in **step I** and **step II** are reversible, to drive the formation of ethyl acetoacetate to completion, excess of sodium ethoxide has to be taken in **step-I**. The excess of sodium ethoxide, however, converts ethyl acetoacetate into its sodium salt. Ethyl acetoacetate is regenerated from its salt upon acidification.

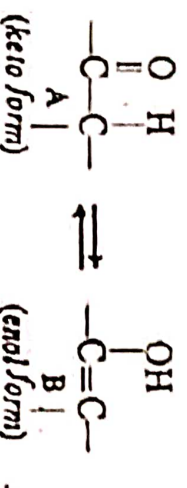


Properties

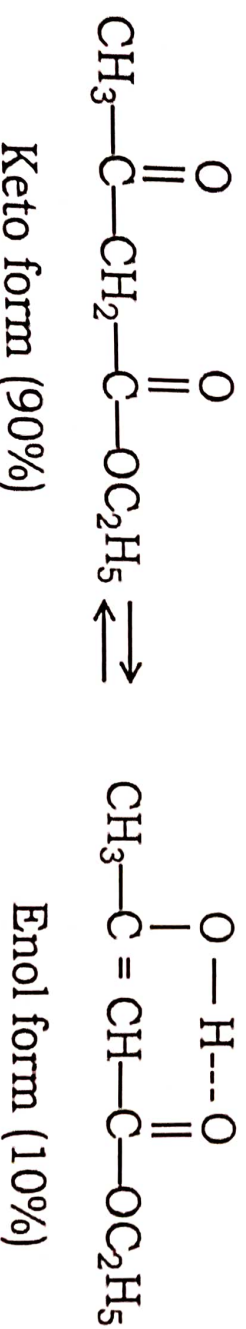
- It is a colourless pleasant smelling liquid
- b.p. - 180.4°C
- It is sparingly soluble in water but freely so in organic solvent.
- It is neutral to litmus.

Chemical properties

Tautomerism is the phenomenon in which two isomeric forms having different functional group are spontaneously interconvertible and can exist in dynamic equilibrium. The two forms in tautomeric equilibrium are called tautomer of each other. All carbonyl compounds: aldehyde, ketones and esters exhibit tautomerism.



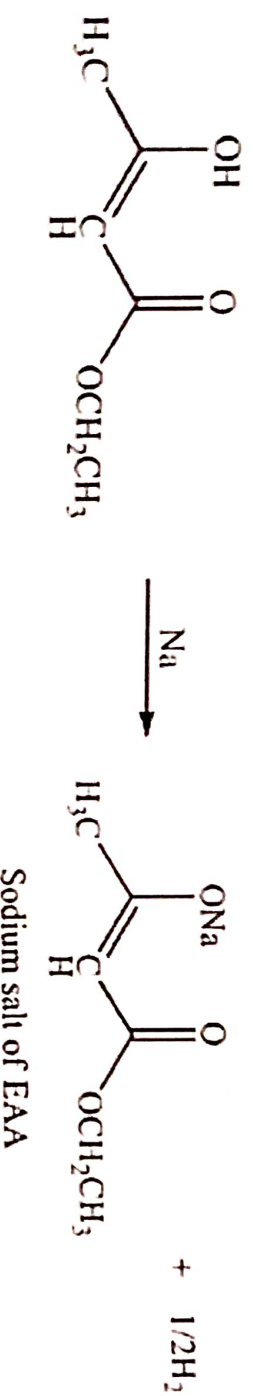
Ethyl acetoacetate is a tautomeric mixture of Keto and enol forms.



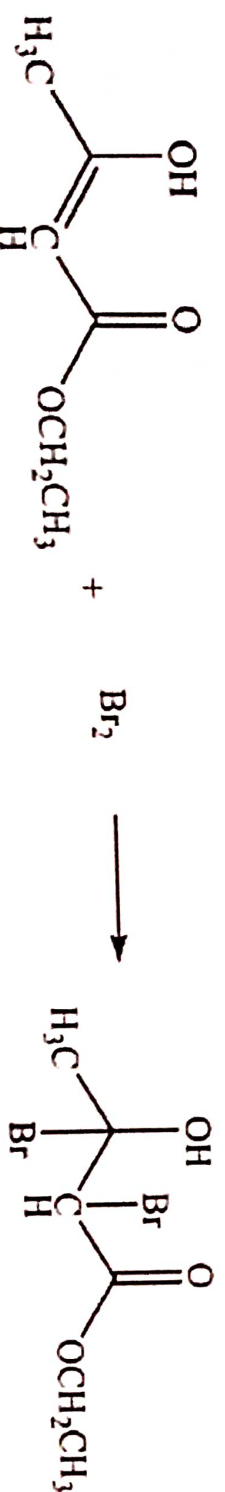
Gaether (1863) suggested the **enol structure**, while Frankland and Duppa (1865) independently proposed the **keto structure** of ethyl acetoacetate. The presence of each of the *enol* and *keto* forms in ethyl acetoacetate was supported by two sets of reaction.

**(A) Reaction supporting enol form or reaction of an unsaturated alcohols
(Evidence in favor of the Geuther formula)**

(i) When acetoacetic ester is treated with metallic sodium, hydrogen is evolved and the sodium derivative is formed. This showed the presence of a hydroxyl group.

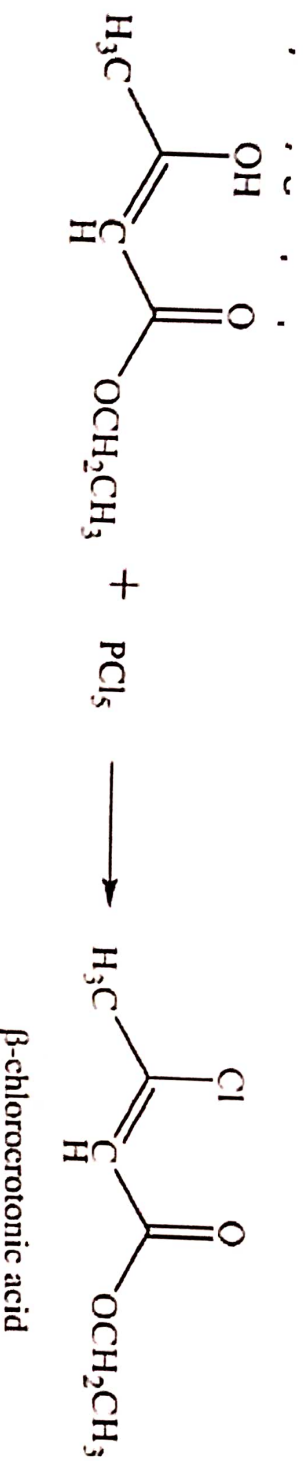


(ii) When acetoacetic ester is treated with an ethanolic solution of bromine, it readily decolourises. This indicates the presence of an olefinic double bond.



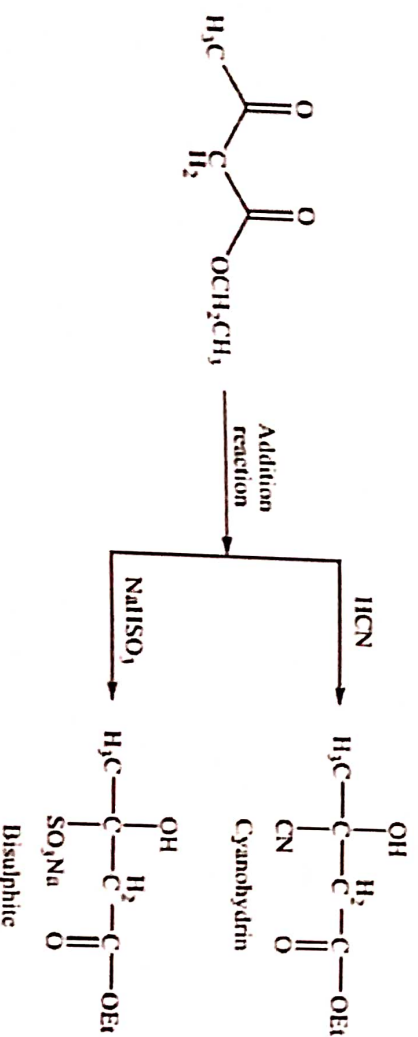
(iii) When acetoacetic ester is treated with ferric chloride, a reddish-violet colour is produced. This is characteristic of compounds containing the enolic group (-C(OH)=C)

(iv) On treatment with PCl_5 , it forms ethyl ester of β -chloroacetic acid. PCl_5 is used for the conversion of hydroxyl group into chloro functionality. Hence it has been again proved from this reaction that hydroxyl group is present in EAA.



(B) Reaction supporting Keto form (Evidence in favour of the Frankland-Duppa formula)

1. EAA forms addition products with HCN and NaHSO_3 , indicating presence of carbonyl ($>\text{C}=\text{O}$) group.



2. It reacts with hydroxylamine (NH_2OH) and phenyl hydrazine (PhNHNH_2) to form oxime and phenyl hydrazone respectively. Formation of oxime and hydrazone is characteristic of compound containing ketone group.

