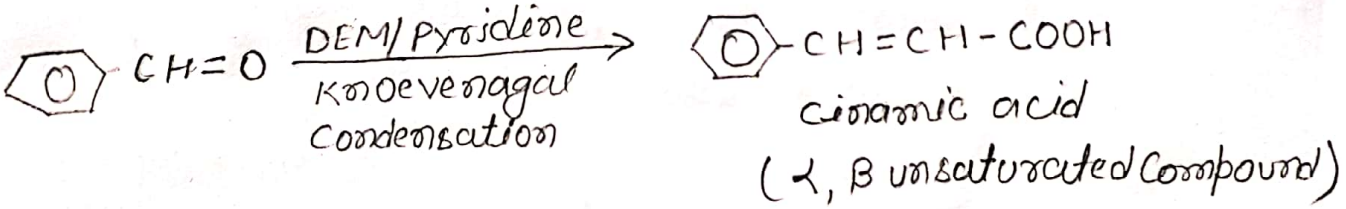
SUBJECT - CHEMISTRY
CLASS - B.Sc(Hons) PART-II
PAPER-IV GROUP-B
TOPIC - Knoevenagal Condensation

Dr Hari Mohan prasad Singh
Department of Chemistry
Dr. L.K.V.D College Tajpur Samastipur

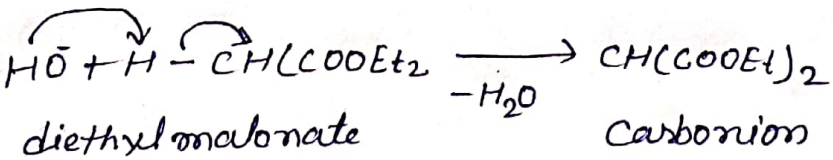
Knoevenagal Condensation

This is the Condensation reaction of Carbonyl Compounds and Compounds Containing active methylene groups ($-CH_2$ group bonded to two-M groups) e.g diethyl malonate (DEM), ethyl acetoacetate (EAA), ethyl cyano acetate (ECA) in presence of a weak base e.g ammonia or its derivatives to form α, β unsaturated Compounds.



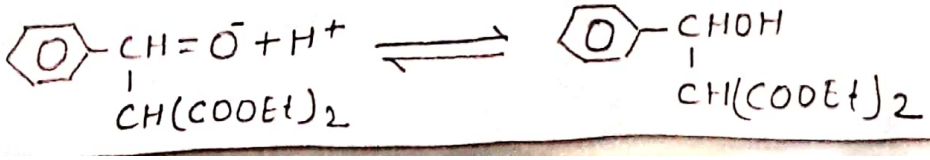
This reaction occurs through following steps –

(i) Deprotonation by base to form Carbanion –

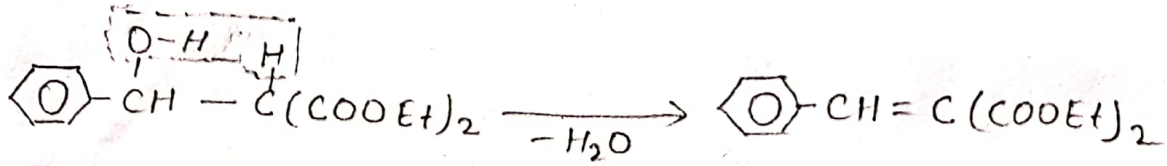


(ii) Attack of Carbanion on the Carbonyl Carbon of the Carbonyl Compounds –

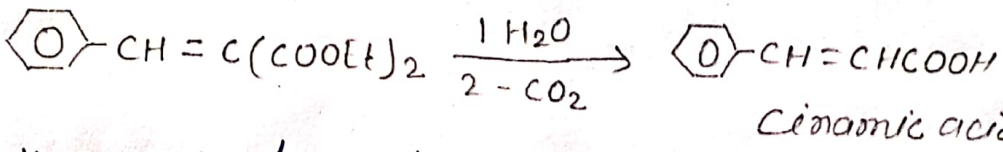
(iii) Protonation –



(IV) Dehydration -

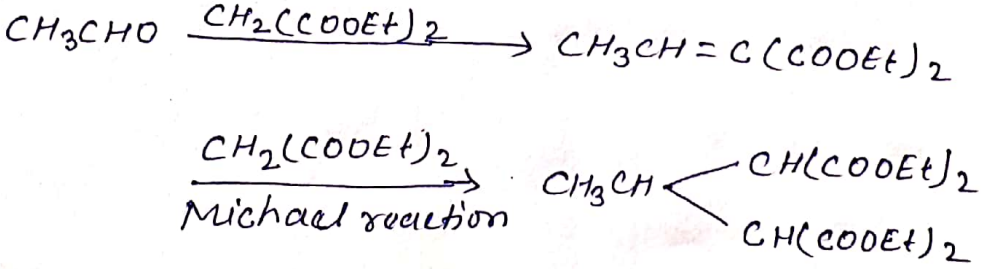


(V) Hydrolysis followed by decarboxylation to yield an α,β unsaturated acid

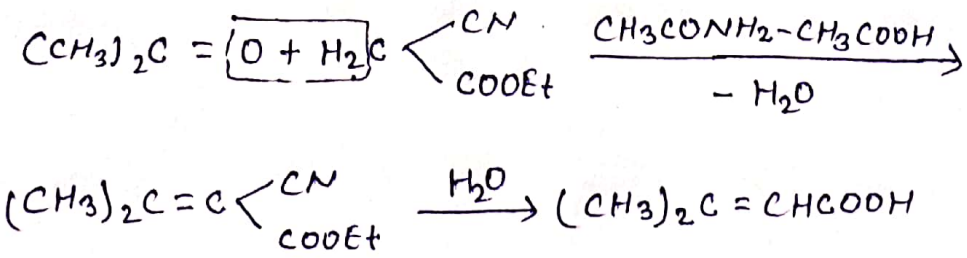


Cinnamic acid

Knoevenagal reaction is more useful with aromatic than with aliphatic aldehydes, since the product with latter further undergoes Michael reaction

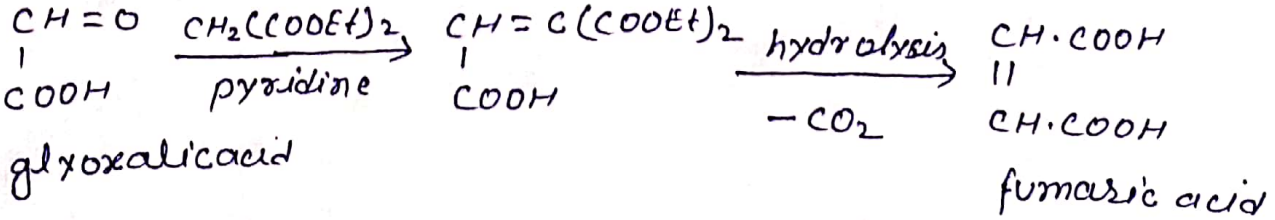


Furthermore, ketone also donot undergo knoevenagel reaction with malonic acid or its esters but can do so with more active cyanoacetic acid and its esters



Applications :

(1) Synthesis of unsaturated acids -

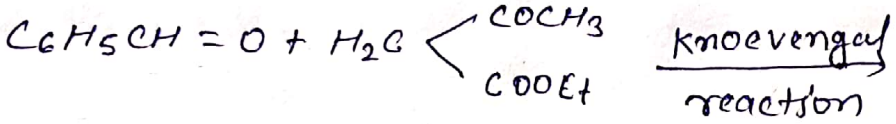


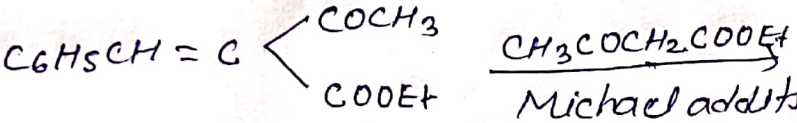
glyoxalic acid

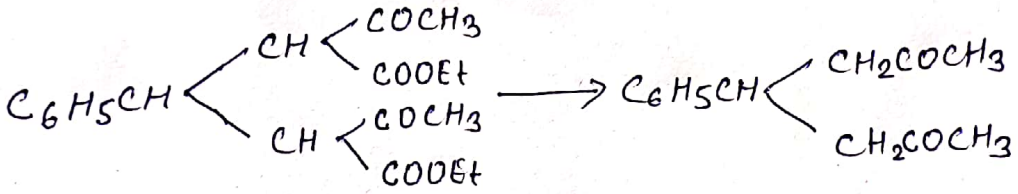
fumaric acid

(iii) Synthesis of 1,5-diketones and cyclohexane derivatives:

When an aldehyde and active methylene compound are treated in 1:2 molar proportion, they give a bis (active methylene) product which on hydrolysis followed by decarboxylation yields a 1,5-diketone -







further 1,5-diketone undergoes cyclisation on treatment with alcoholic alkali to form cyclohexene derivative.