THINK INDIA JOURNAL ISSN: 0971-1260
Vol-22-Issue-16-August-2019

Reactions Involved In Carbon-Carbon Bond Formation: A Review

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Abstract: -A covalent bond between two carbon atoms makescarbon–carbon bondformation. C-C bond composed of two electrons and that is the most common form. Sigma bond consider as acarbon–carbon single bond and is formed between one hybridized orbital from each of the carbon atoms. Various reactions promoted through carbon-carbon bond formation such as Suzuki reaction, Aldol condensation, wittig reaction, friedal craft and so on.In carbon-carbon bond, every reaction proceeds different mechanism.

1. Introduction:-

Each organic molecule made by carbon–carbon (C–C) bond and it is the 'mainstay' of almost organic molecule, and lies at the heart of the chemical sciences.Establishment of Carbon-carbon bond is the basic step for all of organic chemistry which is used to produced various pharmaceutical compounds that having pharmacological activity. Single,double and triple C-C bonds have been described through various types of reaction. Two carbon atoms createmolecular bond of carbon–carbon bond.The most natural structure is the single bond involved two electrons, one from every one of the two iotas. A concoction bond between two molecules including two valence electrons is commonly a sigma bond that emerges between one hybridized orbital from every C iota. Hybridization happens diverse in each bond like C particles in the one bond need be of not a same hybridization. In alkenes, double bonds form in carbon carbon compounds and triple bonds in alkynes. A sp2-hybridized orbital and a p-orbital that isn't engaged with the hybridization structure a twofold bond, while a triple bond develops from a sp-hybridized orbital also twice p-orbitals from every molecule. The utilization free weight molded orbital structures a pi bond.

2.Various reactions of Carbon-Carbon bond formation and their applications:-

2.1.SuzukiCoupling:-

It is also referred as **Suzuki–Miyaura reaction.** The common scheme for the Suzuki reaction is exposed below where organoboron species reacted with alkyl halide used as abase and catalyst (palladium, Pd) formed a carbon-carbon single bond compound. It is usually used to substituted biphenyls and poly-olefins, styrenes.
Example: - bronic acid is treated with bromohalide in the occurrence of potassium carbonate (base) and palladium triphenylphosphine benzene (catalyst) formed biphenyl compound [1-3].

- It is lucrative for the synthesis of intermediates of pharmaceutical chemicals that formed by carbon-carbon compound.
- It is ever-increasing coupling partners for the halide or pseudo-halide atoms by Suzuki coupling reaction and also originatereplacements for halides
- A natural product, capparatriene produced by Suzuki reaction that is highly potent in the treatment of leukemia[4]**.**

2.2 Aldol-Condensation:-

It is a Classic reaction to form carbon-carbon bond compounds. In this reaction, alkenols or enolate particle responds with a carbonyl mixes to create βeta-hydroxyketo-enol form (Aldol reaction). It is especially useful reaction for the formation of β-hydroxyaldehyde or β-hydroxyketone compounds in organic chemistry[5].

- **Aldol condensation** especially used in biochemistry, in case of biological source, the Aldol condensation seen, which is catalysed by the aldolases enzyme in the human body.
- It is used for the synthesis of chalcones and pharmaceutical compounds like α,β-unsaturated ketones.
- It is mainly used for the formation of plasticizers.
- This reaction is used for the production of solvents like alcohol isophorone and diacetone.
- This reaction creates C-C bond in gluconeogenesis and photosynthesis.

2.3.Grignard reaction:-

This response continues when alkyl, vinyl, and aryl-halides are responded with magnesium component on carbonyl assembly in an aldehyde and ketone and this is organometallic concoction response which produce compound within the sight of Grignard reagent. In this plan, a halide treated with magnesium isn't a Grignard response, in any case, gives a Grignard reagent to the finishing of response. The carbon connected to magnesium functions nucleophile, assaulting the electrophilic carbon molecule that is available inside the polar obligation of a carbonyl collection. The development of the Grignard reagent to the carbonyl ordinarily regularcompletes a six ring progress state [6].

R= Alkyl, vinyl,

X= Cl, Br, or I (halogen)

- This reaction is used for the preparation of fluconazole[7].

2.4.Claisen condensation:-

Claisen Condensation occurs in insidetwoester molecules containing α molecule, and which reacted in presence of sodium ethoxide, which is act as a base then that produces the β-ketoesters. This sodium ethoxide involved in the patternof the stabilized anion of the β-ketoester.On the off chance that one of the ester joined forces with enolizable α-hydrogens and another ester doesn't associated with the development of enolization(e.g., aromatic esters or carbonates). The mixed reaction like crossed claisen condensation will be synthetically useful. If the nitriles and ketones are used as the donor in the condensation reaction, that produces the β-diketone or a β-ketonitrilerespectively.Sodium amide or sodium hydride are used as strong bases instead of sodium ethoxide, often increases the yield.

2.5. Friedal craft opinions:-

a.Alkylation:-

Generally Friedal crafts reactions occur in presence of lewis acids. Alkylation can be done by using friedal crafts alkylation, in that benzene ring reacts with tertiary alkyl halide in the nearness of a solid lewisacid i.e $AlCl_3$ which produces the alkyl substituted aromatic compound.

b. Acylation:-

Another friedal creates response includes in the acylation, the acylating operators are acyl chlorides. This acylation additionally happened in nearness of lewis corrosive as it were. Ordinary Lewis corrosive impetuses are acids and aluminum trichloride. The impetus aluminum chloride ought to be include stoichiometric sum. Another friedal creates response includes in the acylation, the acylating operators are acyl chlorides. This acylation additionally happened in nearness of lewis corrosive as it were. Ordinary Lewis corrosive impetuses are acids and aluminum trichloride. The impetus aluminum chloride ought to be include stoichiometric sum. The carbonyl group has electron withdrawing effect it is useful in the synthesis of different compounds. Also, there is no carbocation revision, and the acylium particle is balanced out by a reverberation structure in which the positive charge will be available on the oxygen.

2.6. Diels alder reaction:

The Diels-alder response is a type of reaction in which the chemical reaction accurs in between a conjugated diene and dienophile.How both diene and dienophile were reacted together that forms the substituted cyclic compound. This is the example of pericyclic reaction with a intensive mechanism. More specifically it is [4+2] cycloaddition reaction, that means 4 member carbon compounds reacts with 2 member carbon compound which produces the 6 membered compound. They got Nobel prize for this reaction in the year 1950. The synchronous development of two new carbon bonds the Diels birch response gives dependable approach to frame the six membered ring. This method is useful for the synthesis of new chemical molecules as well as natural products This ring reaction also has been involved in the other ring sizes. This reaction is favorable at high temperatures, although important for blend of Diels-Alder adducts also involved in the retro-Diels-Alder reaction [9-12].

2.7. Wittig reaction:

Wittig response was introduced by Georg Wittig in 1950. This reaction occurs in between an aldehyde or ketone with triphenyl phosphine, which yields alkene and triphenylphosphine oxide. Wittig reaction is ordinarily utilized for the couple aldehydes and ketones to unequivocally triphenylphosphiniumylides. The produced alkenes may present in either E form or Z form [13].

2.8. Baylishilman reaction: -

The Baylishilman reaction involved in the formation of secondary alcohols. In this the reaction occurs in between alkene with aldehyde which catalyzed by a tertiary amine. Phosphines are likewise be utilized in this response and enantioselective responses might be completed if the amine or phosphine is hilter kilter impetus [14].

2.9. Heck reaction: -

The Heck response is one of the named reaction used for the production of substituted alkenes. In this the reaction occurs in between an halide reacts include the alkene in contrasrt of palladium catalyst. This response is one of the models for the carbon-carbon arrangement within the sight of palladium [15-16].

2.10. Michael reaction:

The Michael expansion is one sort of nucleophillic expansion, in which development of carbanion or another nucleophile to the α, β-unsaturated carbonyl compound. This response has a merge with the group of conjugate augmentations. This is likewise one of the generally utilized responses for the development of carbon - carbon bond, in which many variants may exist. In this expansion R1 and R2 substituent's on the nucleophile are electron hutching back tracking like acyl and cyano making methylene hydrogen acidic shaping the carbanionshow with the base. The substituent on the alkene is known as Michael acceptor and the nucleophile known as Michael giver [17].

2.11. Reimer timeen reaction: -

The **Reimer–Tiemann reaction** is used for the ortho-formylation of phenols. When the phenol reacts with the chloroform in the presence of potassium hydroxide which forms the formyl group at ortho position to the phenol.The mechanism involved in this reaction is chloroform is deprotonated by the strong base to form chloroform carbanion, which will quickly eliminates the electrons and forms dichlorocarbene. The hydroxyl will also depronate the phenol to give a negatively charged phenoxide. The negative charge is delocalized into the aromatic ring, making better nucleophillicin nature. Nucleophillic attack of the dichlorocarbene gives an intermediate compound dichloromethyl substituted phenol [18].

3. Result and discussion:-

In carbon carbon bond formation reaction obtained different type of bond such as single referred as alkanes, double referred as alkenes, and triple bond referred as alkynes. Various types of reaction like Suzuki coupling reaction, riemer-timeen reaction, Grignard reaction, aldol condensationetcdemonstrate different carbon carbonbond compounds.

4. Conclusion:

We have studied basic reaction steps of carbon carbon bond reactions with different types of reaction such as Suzuki reactions, Claisen condensation,Grignard reaction, and aldol condensation etc. Carbon-to-carbon individual bond forming respomces involving *sp*3, *sp*2 and *sp* carbon centres. Carbon atom is the first choice in organic chemistry for design the new molecule because it modified very easily and consume less time.

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