

## Proline Catalysed Aldol Reaction Related with Organocatalysis

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### DESCRIPTION

A suitable catalyst is required for the proline catalysed aldol reaction, which converts a combination of two or more carbonyl molecules into a  $\beta$ -hydroxy carbonyl compound. The following two things could act as the catalyst: Other organic catalysts, bases or acids (If the reaction is organocatalytic). The resultant substance is known as an aldol. (Aldol=Aldehyde+Alcohol). An example: (of Aldol Condensation).

Enol/enolate ion + a carbonyl compound =  $\beta$ -hydroxyaldehyde /  $\beta$ -hydroxyketone

Chemical reactions can be sped up using organocatalysis, which uses tiny organic molecules mostly made of C, H, O, N, S, and P. When compared to (transition) metal catalysts, the advantages of organocatalysts include their lack of sensitivity to moisture and oxygen, their quick availability, low cost, and low toxicity, which offers a significant direct benefit in the manufacture of pharmaceutical intermediates. The process of accelerating chemical reactions by including a substoichiometric amount of an organic substance is known as organocatalysis. The novelty of the idea and, more crucially, the fact that the efficiency and selectivity of many organocatalytic reactions meet the standards of well-established organic reactions has both dramatically raised interests in this topic in recent years. Organocatalytic processes are developing into potent tools for building intricate molecular skeletons. In general, low molecular weight chemicals are used as organo-catalysts. In essence, they can be divided into chiral and achiral types.

One of the first substances to be explored as an organocatalyst was proline, a cheap, naturally occurring amino acid that is widely available in both enantiomeric forms. As a Bronsted acid or a Bronsted base, proline can participate in a variety of organocatalytic processes. It can also readily produce the iminium or enamine intermediates that are typical of covalent organocatalysis. It is becoming more and more important to create synthetically beneficial reactions that may be carried out in aqueous environments due to the importance of reducing the formation of residues formed by volatile organicsolvents.

From the perspective of sustainable chemistry, the synergistic combination of the benefits of using water as a reaction medium and the effectiveness connected to reactions that can produce many bonds in a single step is particularly pertinent.

### Advantages

It has the following benefits;

- It produces an enantio-selective product.
- It requires only a little amount (equivalent) of catalyst to carry out the reaction.
- It is inexpensive.
- It is not sensitive to moisture and oxygen.
- There is no metal contamination.
- Multiple stereocenter formation.

### Disadvantages

It takes longer than reactions with metal catalysts.

### Noncovalently supported organocatalysts

A noncovalent bond is frequently used to bind organocatalysts to insoluble supports like montmorillonite and  $\beta$ -cyclodextrin. Despite the weak bond strength in a catalyst that is noncovalently supported, the catalyst can still be employed directly for immobilisation without the need for any modifications or further synthetic procedures. It is practical to combine (S)-proline derivatives with  $\beta$ -cyclodextrin to support an organocatalyst that is not covalently bound.

### Radical $\alpha$ -oxidation using organocatalysts

Comparatively few examples of chiral Lewis acid-mediated enantioselective radical reactions use organocatalysts as the mediator. The enantioselective  $\alpha$ -oxidation of aldehydes with TEMPO, which takes place via a radical cation intermediate, has been established by scientists. They discovered that chiral imidazolidinone has more enantioselectivity than proline or diphenylprolinol, and as a result, under the effect of the catalyst, aldehyde goes through TEMPO-mediated oxidation and subsequent reduction to produce a product with 90% ee.

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**Received:** 29-Aug-2022, Manuscript No. JTC-22-19581; **Editor assigned:** 31-Aug-2022, PreQC No. JTC-22-19581 (PQ); **Reviewed:** 14-Sep-2022, QC No. JTC-22-19581; **Revised:** 20-Sep-2022, Manuscript No. JTC-22-19581 (R); **Published:** 27-Sep-2022, DOI: 10.37532/2157-7544.22.13.309.

**Citation:** Wei L (2022) Proline Catalysed Aldol Reaction Related with Organocatalysis. J Thermodyn Catal. 13:309.

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