Synthetic Routes And Biological Activities of Oxalic acid and its Derivatives

Mulagani prashanthi evangelin,Asst Professor,Southern Institute of Medical Sciences,
Bapathu Ramya Reddy,Doctor of Pharmacy,SIMS,Guntur.
Muthavarapu Sreeja chowdary, Doctor of Pharmacy ,SIMS,Guntur.
Kumbha Nikhila,SIMS, Doctor of Pharmacy ,Guntur..
Kondeti.Meghana, Deparment of Pharmacy ,SIMS,Guntur.
Tejaswini,Analyst in Hetero Pharma,Hyderabad.

Abstract

Amino acids are a group of organic compounds containing two functional groups amino and carboxyl groups. The amino group ($-NH_2$) is basic while the carboxyl group (-COOH) is acidic in nature. More than 300 amino acids occur in nature. Of these, only 20 amino acids are repeatedly found in the structure of proteins, isolated from different forms of life- animal, plant and microbial. This is because of the universal nature of the genetic code available for the incorporation of only 20 amino acids when the proteins are synthesized in the cells. The process is in turn is controlled by DNA, the genetic material of the cell. Hence these are called as essential amino acids.

Keywords:oxalic acids,Amino Acids.

Introduction

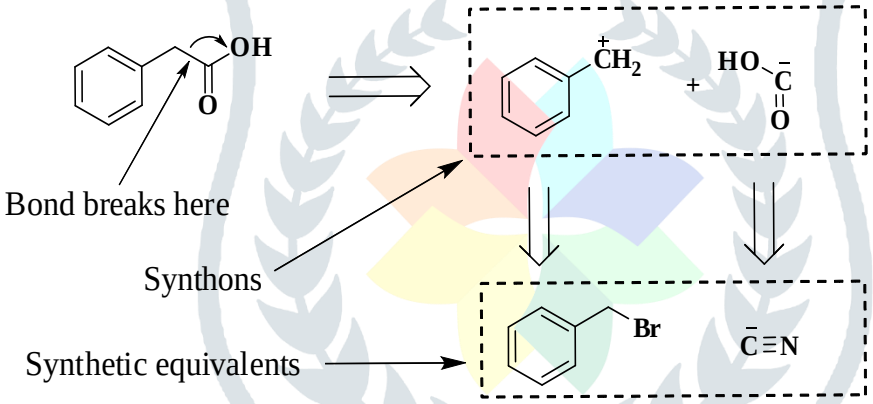
Over the last few decades, natural amino acids which are inexpensive, readily available have some fundamental biological roles. For instance, they are used as enzyme inhibitors or more in general, investigated as therapeutic agents, in addition they are important for probing the structural requirements for the bioactivity of numerous peptides and proteins and also endowed with a wealth of chirality and valuable features, have comprehensively served as ‘chiral synthon’ resources to access a nitrogen containing compounds including alkaloids.[1] Thus both D and L-amino acids are used as chiral directing auxillaries in organic synthesis.

Diastereomers will have different configurations at one or more (but not all) of the equivalent (related) stereocenters and are not mirror images of each other. Diastereomers have different physical properties (unlike enantiomers) and different chemical reactivity. Cis-trans isomerism and conformational isomerism are also forms of diasteromerism. When two diastereomers differ from each other at only one stereocenter they are epimers. Each stereocenter give rise to two different configurations and thus increases the number of stereoisomers by a factor of two. (2^n where n= number of stereocenters). Diastereoselectivity is the preference for the formation of one or more than one diastereomer over the other in an organic reaction.

Enantiomers are non-superimposable mirror images of one another. Enantiomers have similar physical and chemical properties and show different plane of polarization (+/-).

A chiral molecule is a type of molecule that lacks an internal plane of symmetry. The feature that is most often the cause of chirality in molecules is the presence of an asymmetric carbon atom. The term chiral in general is used to describe an object that is not superimposable on its mirror image. In chemistry, chirality usually refers to molecules. A synthon is a concept in retrosynthetic analysis. It is defined as a structural unit within a molecule which is related to a possible synthetic operation. In other words, a synthon is a specific component (compound) that can be used to make a product. Now a days synthon is preferably used as synthetic building block rather than retrosynthetic fragmentation structures.

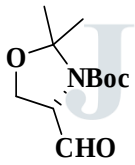
For example:



A chiral synthon is a component (compound) that can be used to make a chiral product by using inbuilt chirality (i.e., a compound that induces chirality). Chiral pool synthesis is a strategy that aims to improve the efficiency of chiral synthesis. It starts the organic synthesis of a complex enantiopure chemical compound frock of readily available enantiopure substances. Common chiral starting materials include monosaccharide and amino acids. This strategy is especially helpful if the desired molecule bears a great resemblance to heap enantiopure natural products. General methods used in chiral pool synthesis are the use of protecting groups and functional group interconversion (FGI).

In organic synthesis, amino acids are used as chiral directing auxillaries due to its of chirality. For these reasons, many efforts have been made in recent years to the preparation of homo chiral non-natural amino acids. Several methods have been developed to introduce chirality during the synthesis of a new amino acid. In many cases the requested configuration is provided by the starting material and maintained throughout the synthetic sequence by means of reactions that do not affect the stereocenter.

Based on this, many attempts were done for the preparation of Garner's aldehyde from the *L*-serine finally in 1984 Garner published a method for preparing the configurationally stable 1,1-dimethylethyl 4-formyl-2,2-dimethyl-oxazolidine-3-carboxylate (**1**), today called Garner's aldehyde which has been used extensively as chiral building block in asymmetric synthesis. Garner's aldehyde has, in a very short time, proven an extremely useful chiral building block in organic synthesis.[2] Its value is due to its simple structure which allows that to use for synthesizing many targets and also because of good methods exist for diastereoselective elaboration of aldehydes. Therefore tremendous applications were found as a chiral pool reagent in the synthesis of various nitrogen-containing compounds.[3] It was anticipated that similar simple chiral building blocks for alternative purposes are in demand. The search for efficient chiral synthons, which are easily accessible and stable for longer periods of time is of great importance in organic synthesis. However, the scope of amino acids as chiral synthons relies on the expansion of key intermediates desired for synthesis.



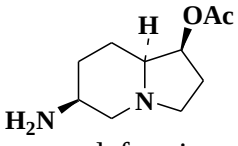
1

Garner's aldehyde

Naturally occurring chiral compounds are often used for this purpose but the synthesis of new useful non-racemic building blocks also received prominence in the synthesis of enantiomerically pure complex bio-active natural products and pharmaceutical agents via further structural and stereochemical elaboration.[4]

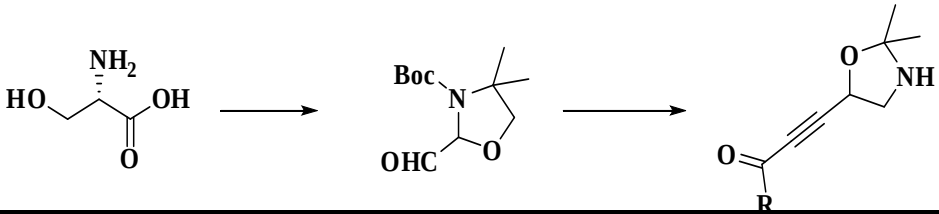
REVIEW OF LITERATURE

1. Mukund P. Sibi and James W. Christensen., *et.al.*,[5] Enantiospecific synthesis of (-)-Slaframine and related hydroxylated indolizidine, utilization of a Nucleophilic Alaninol synthon derived from serine, *J. Org. Chem*, *64*, **1999**, 6434-6442.



slaframine

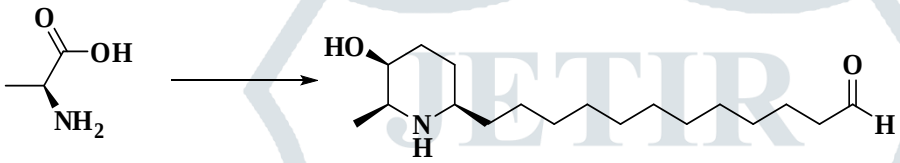
2. Jose M. Villalgordo *et.al.*,[6] A highly efficient and straight forward stereoselective synthesis of novel chiral α-acetylenic ketones. *Tetrahedron: Asymmetry*, *10*, **1999**, 3417-3430.



3. Russell. J. Cox and Paul. S. H. Wang, *et. al.*,[7] Synthesis and in vitro enzymatic activity of aza, oxa and thia derivatives of bacterial cell wall biosynthetic intermediates. *J. Chem. Soc. Perkin Trans-I*, **2001**, 2022-2034.

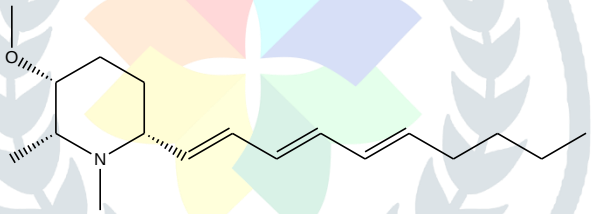
4. Remiguisz zurawinski *et. al.*,[8] Bicatalytic synthesis of chiral non-racemic 2-hydroxyalkanephosphonates. *Tetrahedron: Asymmetry, 12*, **2001**, 3139-3145.

5. Yui Masuda, Kenji Mori *et. al.*,[9] Synthesis of (+)-Carpamic acid from (+)-alanine, *Tetrahedron: Asymmetry, 17*, **2006**, 3380-3385.



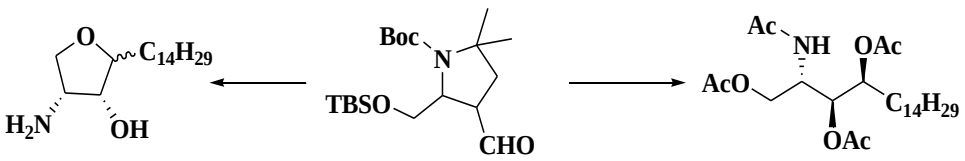
Alanine (+)-Carpamic Acid

6. Yusuke Nakatani *et. al.*,[10] Enantioselective total synthesis of (2R, 3R, 6R)-N-methyl-6-(decca-1',3',5'-trienyl)-3-methoxy-2-methylpiperidine, an insecticidal alkaloid. *Tetrahedron, 62*, **2006,** 160-165.



7. Alexander popkov *et. al.*,[11] New chiral synthons of ^{13}C- or ^{15}N-labelled α-amino acids. *Journal of Labelled Cmpounds and Radiopharmaceuticals, 50*, **2007**, 554-555.

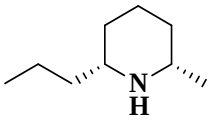
8. Elin Abraham, E. Anne Brock *et. al.*,[12] Asymmetric synthesis of N, O, O, O-terta-acetyl D-lyxophytosphingosine, jaspine B(pachastrissamine), 2-epijaspine and deoxoprosophylline via lithium amide conjugate addition. *Org. Biomol. Chem.*, *6*, **2008**, 1665-1673.



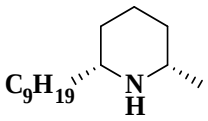
Jaspine B
or Epijaspine

N,O,O,O-tetra-acetyl d-lyxo
phytosphingosine

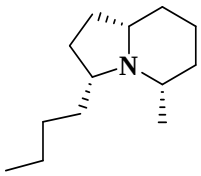
9. Ch. Raji Reddy, B. Latha, *et. al.*,[13] Synthesis of (-)-dihydropinidine, (2S, 6R)-isosolenopsin and (+)-monomorine via a chiral synthon from L-aspartic acid, *Tetrahedron: Asymmetry*, *22*, **2011**, 1849-1854.



(-)-dihydropinidine

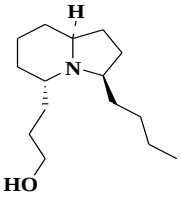


(2S, 3R)-isosolenopsin

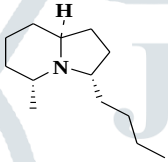


(+)-Monomorine

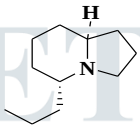
10. Ch. Raji Reddy, B. Latha, N. Narasimha Rao, *et. al.*, [14] Enantioselective access to (-)-indolizidines 167B, 209D, 239AB, 195B and (-)-monomorine from a common chiral synthon, *Tetrahedron*, *68*, **2012**, 145-151.



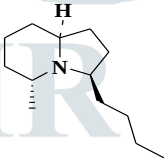
(-)-indolizidine 239AB



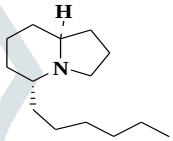
(+)-Monomorine



(-)-indolizidine 167B



(-)-indolizidine 195B



(-)-indolizidine 209D

1. (a) Coppola, G. M.; Schuster, H. F. *Asymmetric Synthesis. Construction of Chiral Molecules Using Amino Acids*; Wiley: New York, **1987**; (b) Takhata, H.; Bandoh, H.; Momose, T. *Tetrahedron* **1993**, *48*, 11205-11212; (c) Sardane, F. J.; Rapoport, H. *Chem. Rev*. **1996**, *96*, 1825-1872; (d) Sibi, M. P.; Christensen, J. W. *J. Org. Chem*. **1999**, *64*, 6434-6442; (e) Masuda, Y.; Tashiro, T.; Mori, K. *Tetrahedron: Asymmetry* **2006**, *17*, 3380-3385.
2. Liang, X.; Andersch, J.; Bols, M. *J. Chem. Soc., Perkin Trans.1* **2001**, 2136-2157.
3. (a) Serrat, X.; Cabarrocas, G.; Rafel, S.; Ventura, M.; Linden, A.; Villalgordo, J. M. *Tetrahedron: Asymmetry* **1999**, *10*, 3417-3430; (b) Liang, X.; Andersch, J.; Bols, M. *J. Chem. Soc., Perkin Trans.1* **2001**, 2136-2157.
4. (a) Hanessain, S. In Total Synthesis of Natural Products: The 'Chiron' Approach. In Organic Chemistry Series; Pergamon, Oxford, vol.*3*, **1983**; (b) Danishefsky, S. J.; Allen, J. R. *Angew. Chem., Int. Ed.* **2000**, *39*, 836-863; (c) Nicolaou, K. C.; Mitchell, H. J. *Angew. Chem, Int. Ed*. **2001**, *40*, 1576-1624.
5. Sibi, P. M.; Christensen, J. W. *J. Org. Chem*, *64*, **1999**, 6434-6442.
6. Villalgordo, M. J. *Tetrahedron: Asymmetry*, *10*, **1999**, 3417-3430.
7. Cox, J. R.; Wang, S. H. P. *J. Chem. Soc. Perkin Trans-I*, **2001**, 2022-2034.
8. Zurawinski, R; *Tetrahedron: Asymmetry*, *12*, **2001**, 3139-3145.

9. Masuda, Y.; Mori, K. *Tetrahedron: Asymmetry, 17*, **2006**, 3380-3385
10. Nakatani, Y. *Tetrahedron, 62*, **2006,** 160-165.
11. Popkov, A. *Journal of Labelled Compounds and Radiopharmaceuticals, 50*, **2007**, 554-555.
12. Abraham, E.; Anne Brock, A. *Org. Biomol. Chem., 6*, **2008**, 1665-1673.
13. Raji Reddy, Ch.; Latha, B. *Tetrahedron: Asymmetry* **2011**, *22*, 1849-1854.
14. Raji Reddy, Ch.; Latha, B.; Narasimha Rao, N. *Tetrahedron, 68*, **2012**, 145-151.