

Rajarshi Shahu Mahavidyalaya (Autonomous), Latur

Course Title : Microbial Biotechnology

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Microbial Production, Recovery and Applications of amino acids

3. Tryptophan

- ❑ Tryptophan (symbol Trp or W) is an α -amino acid that is used in the biosynthesis of proteins
- ❑ It contains an α -amino group, an α -carboxylic acid group, and a side chain indole, making it a non-polar aromatic amino acid.
- ❑ It is essential amino acid in humans.
- ❑ It is also a precursor to the neurotransmitter serotonin, the hormone melatonin and vitamin B3

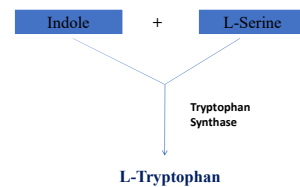
- ❑ Tryptophan was first isolated in 1901, from the milk protein casein, by [Sir Frederick Gowland Hopkins](#).
- ❑ He was awarded the Nobel Prize for his discovery of vitamins, produced by amino acids like tryptophan.

There are different ways of synthesizing L-tryptophan

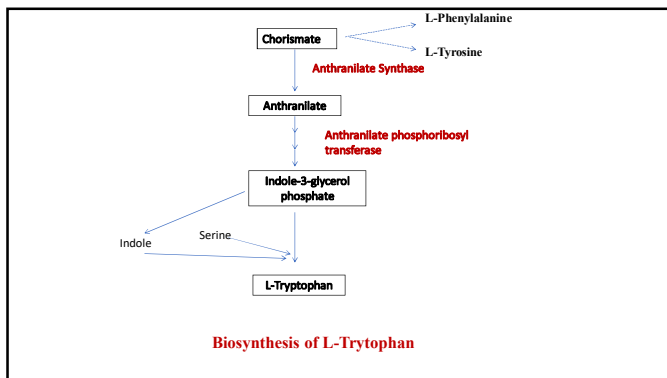
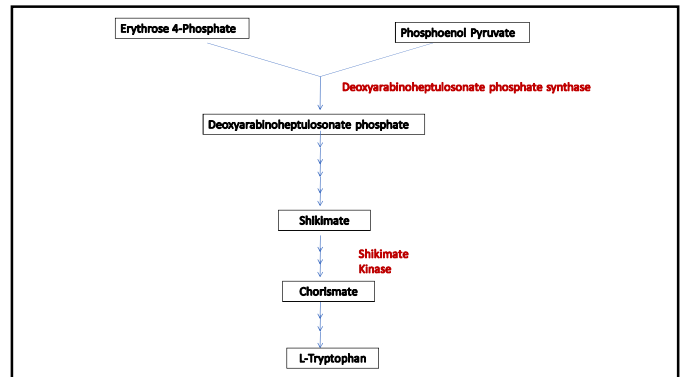
1. Chemical methods,
2. Enzymatic methods
3. Fermentation methods

At present, large scale manufacture of tryptophan is carried out by using the enzyme tryptophan synthase of *E. coli*.

Tryptophan synthase combines indole with L-serine to form tryptophan.



- ❑ Indole is available from petrochemical industries.
- ❑ While L-serine can be recovered from molasses during sugar refinement.
- ❑ Mutant strains of *E. coli* with high activity of tryptophan synthase have been developed for large scale manufacture of tryptophan.



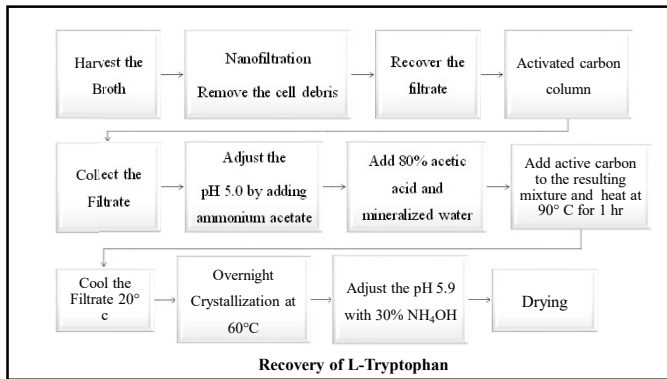
Mutant Strains for Overproduction L-tryptophan:

- ❑ The production of tryptophan by *C. glutamicum* was increased by introducing a second gene encoding anthranilate synthase, a key enzyme in its biosynthesis .
- ❑ Further, genes encoding other important enzymes (deoxyarabinoheptulosonate phosphate synthase, anthranilate phosphoribosyltransferase) were also be modified.
- ❑ The result is that the pathway becomes insensitive to feedback inhibition by end products, leading to an overproduction of L-tryptophan.

Direct Fermentation Process

- ❑ Tryptophan can also be produced by fermentation employing wild type or genetically modified strains of *C. glutamicum*, *E. coli* , *B.amyloliquefaciens*, *B.subtilis*.
- ❑ Media Preparation : Glucose, K_2HPO_4 , $MgSO_4$, $(NH_4)_2SO_4$, asparagine .
- ❑ Carbon source: Molasses
- ❑ Nitrogen Source : Corn Steep liquor
- ❑ Minerals : K_2HPO_4 , $CaCO_3$
- ❑ Antifoam : Silicon RD

- ❑ pH of the fermentation medium is maintained between about 5 and 8 throughout the fermentation (optimum pH 6.8).
- ❑ Temperature between 35 and 37° C.
- ❑ Fermentation Time 72 hrs



Application of Tryptophan

- It is widely used as whitening agents in cosmetics,
- It is used as nutritional supplements in agriculture and animal feed.
- It is used as sedatives and psychotropic drugs.
- It is used as nutritional supplement in beverages.
- It acts as an antioxidant in Food products.
- It is used as Leavening agent in food products .
- It is used in pharmaceuticals to cure migraine headaches, sleep disturbances, weight loss, PMS, obesity, and back pain.

- It is also used as hair conditioning agents and skin conditioning agents
- It may be used in cosmetics and personal care.
- It is also used to synthesize other chemicals

References

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**THANK
YOU**