Amino acid production L-Glutamic acid and L-Lysine :

The production of amino acids may involve any of these processes: microbial fermentation, extraction from animal or plant protein hydrolysates, chemical synthesis, and enzymatic transformation. Fermentation processes mainly employ stains of *Corynebacterium glutamicum* and *Escherichia coli* to produce L-glutamic acid (monosodium glutamate, MSG), L-aspartic acid, L-phenylalanine, L-lysine, L-methionine, L-threonine, and L-tryptophan, from sugar sources such as molasses, sucrose, or glucose. These amino acids serve as building blocks for active ingredients that are applied as pharmaceuticals, cosmetics, and agricultural products . In the future the demand of amino acids in food, feed, pharmaceuticals, cosmetics, agriculture, will lead to further exploration of the potential of microorganisms, plants and enzymes to develop more efficient processes for amino acid production. The industrial production of L-glutamic acid and L-lysine will be discussed in the proceeding sections.

L-Glutamic acid :

Kyowa Hakko, Japan was the first company to start the production of L-glutamic acid by fermentation using *Corynebacterium glutamicum* (syn. *Micrococcus glutamicus*) in the year 1957 after its discovery in the spent medium. *Breviacterium*, *Microbacterium*, *Arthrobacter* are some other glutamic acid producing bacteria. These bacteria are collectively referred as ‘glutamic acid bacteria’ and have some common morphological and physiological characterstics. These bacteria are Gram positive, nonsporulating, nonmotile, require biotin, lack or have little α-ketoglutarate dehydrogenase activity and show high glutamate dehydrogenase activity (p18,19).

microorganisms used. Glucose, fructose, sugar cane and sugar beet molasses, and starch hydrolysates are some carbon sources used in production of L-glutamic acid. Penicillin or fatty acid derivatives (e.g. Tween 60) are added in the sugar cane or sugar beet molasses based medium upsetting the cell wall synthesis of these bacteria as these carbon sources contain high biotin (0.02-0.12 mg/Kg) content favoring the formation of cell membrane with high lipid content. Acetate, methanol, ethanol, acetaldehyde, or n-alkane have also been employed as carbon source in the production of of L-glutamic acid by bacteria, but still cane sugar molasses or starch hydrolysates are the main carbon sources. Ammonium salts or ammonia are generally used as nitrogen source. In case of glutamic acid bacteria having high urease activity, urea can also be used as nitrogen source in the medium.

The optimal biotin concentration in the production medium depends on the carbon source used, i.e., 5μg/L biotin for media with glucose and 0.2 – 1.0 μg/L in case of media containing acetate. L-Cysteine as an additional growth factor is required by some strains and media based on n-alkane require thiamine supplementation. Oxygen supply is necessary for glutamic acid production and under oxygen deficiency, excretion of lactate and succinate occurs, whereas excess oxygen results in ammonium ion deficiency, ceasing the growth and production of α-ketoglutarate, thus lowering the L-glutamic acid yield in both cases. Medium pH during fermentation is maintained at 7-8 by the addition of alkali/ammonia. L-glutamic acid starts accumulating from the mid way of the fermentation process which normally lasts for 30-35 h and finally L-glutamic acid level reaches to 100g/L in the fermentation broth in case of *Brevibacterium divaricatum* (NRRL-B-231) (Miescher, 1975). In acidic pH with excess ammonia, glutamine is produced instead of L-glutamic acid. L-Glutamic acid is recovered from the fermentation broth by separating the cells from the culture medium and its crystallization is done by lowering the pH to 3.2 (isoelectric point) of the cell free broth using HCl. Crystals are then filtered, washed and monosodium glutamate (MSG) is

prepared by adding sodium hydroxide to the crystalline L-glutamic acid followed by recrystallization.