Lab5

Industrial production of Citric Acid

Citric acid (2-hydroxy-propane-1,2,3-tricarboxy-lic acid)

Citric acid: a carboxylic organic acid, solute in water with a pleasant taste is the most importer acid used in the food industries. Despite its wide application in food and pharmaceutical industries, all commercial citric acid was produced from lemon and lime juices, Later on it was reported that citric acid can be produced by Fermentation process using species of microorganisms namely ***Aspergillus nigen*** a fungus which was used commercially for the first time in 1923.

They also indicated that factors affect in the production of citric acid by fermentation include the nutritional composition of the media, environmental conditions, deficiency of manganese and other metals PH and dissolved oxygen tensioner.

At present time, citric acid is produced commercially using mutan strains of ***Aspergillus niger*** and with a significant amount by ***Saccharomycopsis lipolitica***.

Many microorganisms have been evaluated for the production of citric acid including bacteria such as ***Bacillus licheniformis***, ***β.subtils***, ***Corynebacterium spp***. Fungi such as ***A.niger***, ***A. awamort***, ***A. foetidus***, ***penicillium restrictum***. Yeast such as ***candida lipolytica***, ***candida Intermedia*** and ***Saccharomyces cerevisiae***.

However, ***A.niger*** a filamentous fungus remained the organism of choice for citric acid production due to ease of handling its ability to ferment a variety of cheap raw materials, and high Yields:

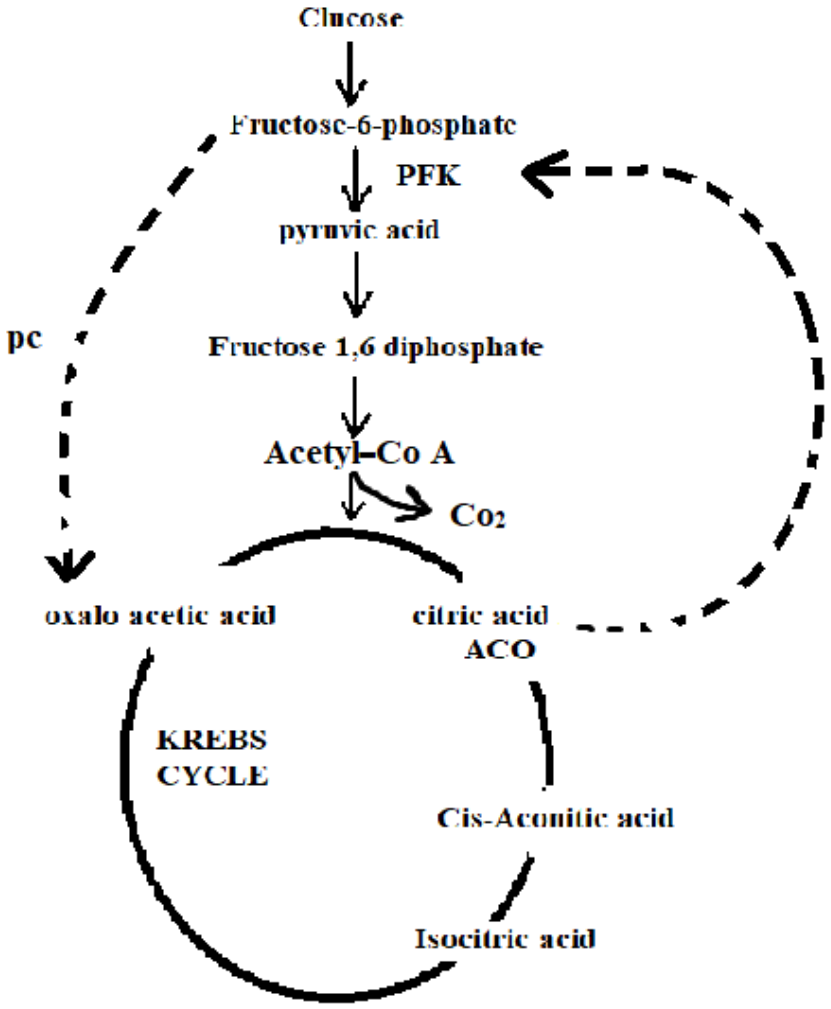
Other carbohydrates and wastes that have been consider experimentally, to produce citric acid by ***Aspergillus niger*** in cludes inulin, date fruit syrup, sugar cane molasses, sugar Beet molasses, soya whey, cheese whey and hydrocarbon a organic (oil derivatives).

Lab5

Biosynthesis of citric acidi:

Citric acid is a tricarboxylic acid it is a primary metabolite product formed in the tricarboxylic acid (or Krebs) cycle and is a weak organic acid found in citrus fruit and in small quantities in virtually all plants and anima being isolated from lemon juice.

Schematic representation of the main metabolic reactions involved in the production of citric acid by A.niger



PFK= phosphor fruc-to kinase

PC= pyruvate carboxylase

ACO= aconitase

Lab5

Procedures:

1- Microorganism: Aspergillus niger.
2- Medium molasses concentration 14% addation

NH_4No_3, $MgSo_4$, $CuSo_4$, $FeCl_3$, $ZnS0_4$, KH_2Po_4, and addation methanol, Na-Ferracyonid.

pH → 6.5 and sterilized autoclave 121°C for 15 min and inoculate A. niger culture (spores suspension 2ml S.S/100 ml medium and incubate in shaker incubater 125 p/min at (28-30°C) for (5-7 days).

Isolation of citric acidi:

The biomass is separated by filtration

The liquid is transferred to recovery process Separation of citric acid from the liquid precipitation calcium hydroxide is added to obtain in obtain calcium citrate tetrahydrate → wash the precipitate → dissolve and it with dilute sulfuric acid yield citric acid and calcium o sulfate precipitate → bleach and crystallization → anhydrous or monohydrate citric acid.

Citric acid determination:

5 ml of sample +3 drops of phenonaphthalen as indicator+ titroation against NaoH 0.1 N

$$\text{Tatal acidity\%} = \frac{0.1\ (\text{NaoH}) \times \text{Volume NaoH} \times \text{Equiv.wt of CA}}{\text{smaple volume}}$$

Equivalent weight of citric acid = 294.1

N= Normality