

Topic: -

FERMENTATION PRODUCT OF BACTERIA.

Fermentation is a metabolic process by which an organism converts carbohydrate, such as starch and sugar, into an alcohol or an acid. Both facultative and obligate anaerobic bacteria produce energy by different types of Fermentation.

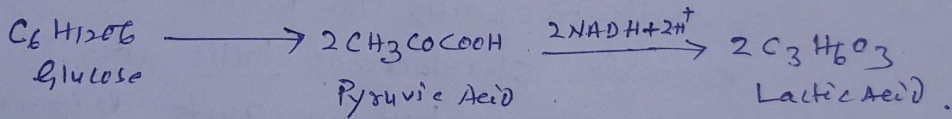
* Types of Fermentation:

The three basic types of fermentations are:-

(i) LACTIC ACID FERMENTATION :-

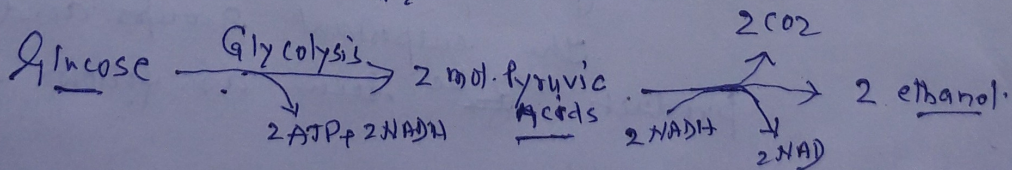
Bacteria (*Streptococcus lactis*) and yeast convert milk glucose into Lactic acid by Fermentation. First Glycolysis breaks one molecule of glucose into 02 molecules of Pyruvic acid.

During the process 2 molecules of ATP and 2 molecules of NADH are produced. 2 NADH molecules and 2 NAD are regenerated are consumed, during the conversion of pyruvic acid into lactic acid. Thus, the net gain is 2 ATP.



(ii) ALCOHOLIC FERMENTATION :-

It is also known as ethanol fermentation; It is a process in which sugars such as glucose, fructose, and sucrose are converted into cellular energy and into ethanol and carbon dioxide as waste products. The process is carried out by various bacteria (*E. coli*), yeasts and molds.



iii) ACETIC ACID FERMENTATION! —

(2)

It is a process of oxidation in which alcohol is converted into acetic acid^(vinegar) by the agency of bacteria of the genus Acetobacter, especially A. aceti. It is called "oxidative fermentations", that creates vinegar as a by product. As these bacteria produce acid, they are usually acid-tolerant, growing well below pH 5.0. The optimum pH for growth is 5.4-6.3.

Acetic acid is produced by fermenting various substrates (Starchy solution, Sugar solution or alcoholic food stuffs) such as wine or cider with Acetobacter bacteria.

In these fermentation processes, acetic acid bacteria form a microbial community, a so called bio film, with other microbes and are important in producing acetic acid.

* However, it is important to note that all microorganisms do not metabolize the same substrate in exactly the same manner. For example Streptococcus lactis and E. coli both ferment glucose but by quite different pathways of fermentation.

* Most heterotrophic bacteria produce several end products. Thus, it is possible to group them on the basis of their products of fermentation (eg. Lactic acid group, Propionic acid group etc.)

The important groups and their products ~~are~~ may be seen as follows —

(3)

Groups with examples of Some Genera.

* Lactic acid bacteria.

- Streptococcus
- Lactobacillus
- Leuconostoc

Products.

(Homo fermentative)

→ Lactic acid or lac. acid + acetic acid,
formic acid, and ethyl alcohol
(= Heterofermentative)

* Propionic acid bacteria — Propionic acid + Acetic acid + CO₂

- Propionibacterium
- Veillonella

* Coli-aerogen-typhoid bacteria. → formic acid, acetic acid, lactic acid, succinic acid, ethyl alcohol, CO₂, etc.

- Escherichia
- Enterobacter
- Salmonella

* Acetone, butyl alcohol bacteria — Butyric acid, butyl alcohol, acetone, isopropyl alcohol, acetic acid, formic acid, ethyl alcohol, hydrogen and CO₂.

- Clostridium
- Eubacterium
- Bacillus

* Acetic acid bacteria. — Acetic acid, gluconic acid, kojic acid.

- Acetobacter

Fig. Fermentation of Glucose by
Different bacteria. ~~give~~ The
Bacteria is grouped according
to major products.

- * Purpose of fermentation — The purpose of fermentation is to generate the electron carriers used in Glycolysis and produce a small amount of ATP (O₂).