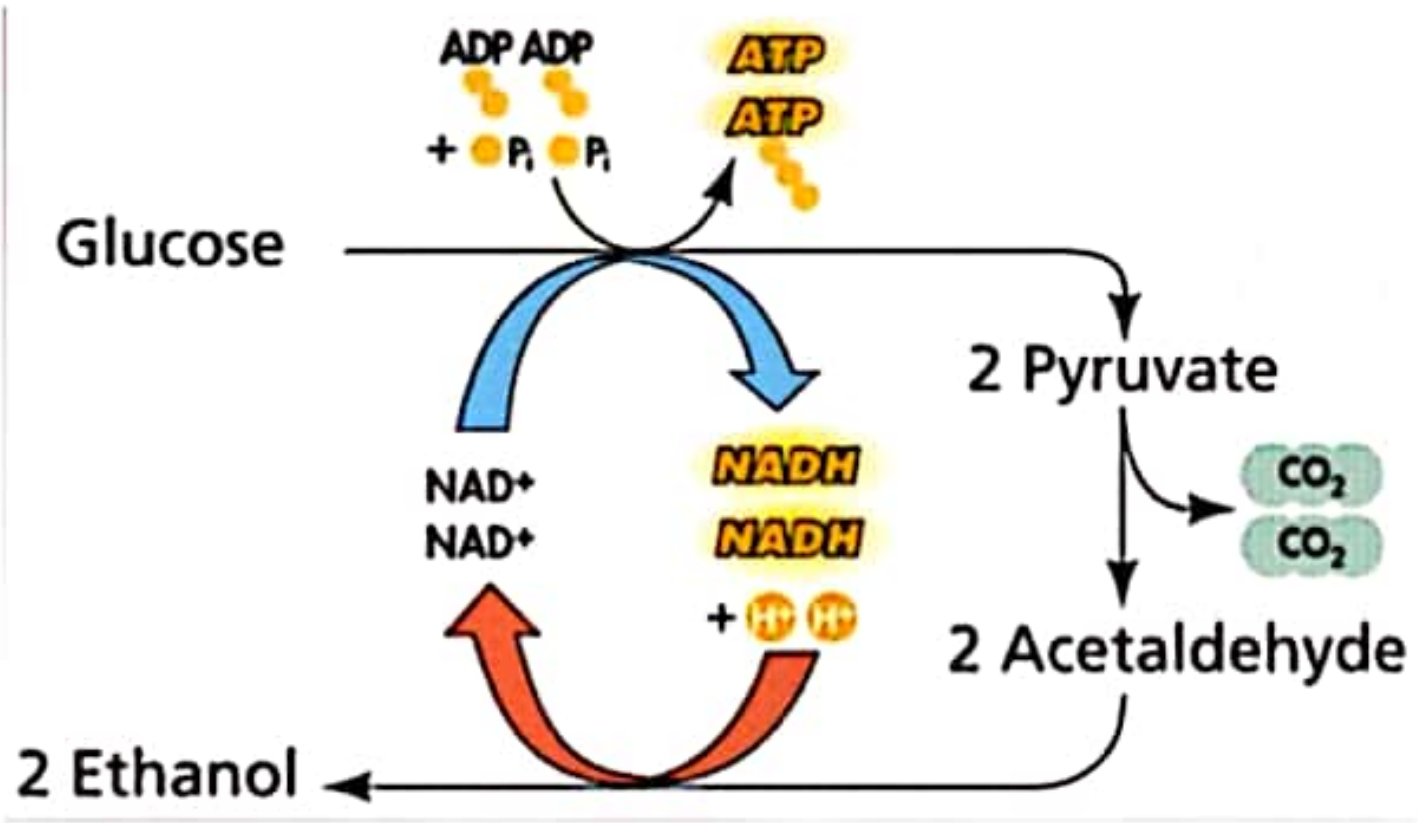
ETHANOL PRODUCTON

Anaerobic Fermentation of alcohol



- Ethanol is used as
  - solvent
  - chemical intermediate
  - fuel

Solvent:-

Resins, pharmaceuticals , cosmetics ,household cleaning products, industrial solvent

Fuel:-

Used as a bio fuel , In internal combustion engines

Chemical intermediate :-

- petroleum derived chemicals
- Butadiene production

Organisms for ethanol production:-

Bacteria:-

- ➢ Many bacteria can produce ethanol
- ➢ Many produce end products
  - Other alcohol
  - organic acids
  - Polyols
  - Ketones gasses
- ➢ Many bac metabolize glucose by EMP pathway
  - Clostridium sps
  - Spirochaeta sps
  - Sarcina sps
  - Streptococcus sps

Yeast

- Primary interest are saccharomyces sps
- Organisms are selected by
  - High growth and fermentation rate
  - High ethanol yield
  - Osmotolerance
  - Low PH
  - High temp
  - Hardiness under physical and chemical stress
  - Ethanol and glucose tolerance(allows conversion of conc feeds to conc products)

RAW MATERIALS

- Saccharine
- Starch &
- Cellulose materials

SACCHARINE:-

- Simple, directly fermentable, 6 & 12 C molecules
- Glucose, fructose, maltose

FRUITS:-

- Grapes – 15%
- Banana – 13.8%
- Apples – 12.2%
- Pineapples – 11.7%
- Pears – 10%
- Peaches – 7.6%
- Oranges – 5.4%
- Watermelon – 2.5%

MOLASSES:-

- Beet or cane molasses
- Contain 52 – 55 % fermentable sugars
- Molasses with above 15 – 20 % sugar cont will need to be dilute
- A ton yeild-70-80 gallons

CANE SORGUM :-

- 14% fermentable sugar content
- Extraction requires heavy duty
- 13-14 gallons of alcohol / ton
- Acidification is necessary

SUGAR BEET :-

- Mostly preferred
- 15% sugar, 82% water, small amount of starch
- Juice Is extracted by crushing
- A ton yield 20 – 25 gallons of alcohol
- Enzymes improve the alcohol yield

SUGAR CORN WASTE :-

- 7 – 15% sugar
- Sugar is extracted as same as sorghum
- 8 – 18% gallons of alcohol per ton
- Back slopping in the range of 20-25%
- Acidification is necessary

Starchy materials:-

- Materials that contain more complex carbohydrates

Grains :-

- Grains must be milled, diluted & coked & fermented
- Contain large amounts of fermentable materials
- Alcohol yield is dependent on converted starch

Jerusalem artichokes :-

- Abundant source of alcohol (16 – 18%) fermentable material
- A ton should yield about 25 gallons of alcohol
- Material should be crushed to pulp & cooked for 2-3 hrs, dilution is not necessary (79 – 80% water)

- PH is adjusted & fermentation is carried out

Potato:-

- 15 -18% fermentable sugar
- A ton yield 20-25% of alcohol
- Cooked with steam under pressure
- After cooking mash is cooled to conversion for 15-20 min
- Once converted PH should be adjusted mash is fermented

Sweet potato:-

- 27-28% fermentable sugar
- A ton should yield 40 gallons of alcohol
- Similar manner to potatoes
- Dilution is required (66%water)