The second product to ferment the sugars:

Next phase after the formation of alcohol from sugary solution such as syrup date, dates,, molasses, fruit juices is produce acetic acid, the second microorganisms (Acetobacter aceti) is added to production of vinegar.

Acetobacter bacteria, all acetic acid bacteria are rod-shape, obligate aerobes, gram-negative which oxidized ethanol (ethanol is the common substrate in acetic acid fermentation formed as a result of fermentation of sugar) can produce vinegar up to 14% acetic acid, throw process called oxidative fermentations, acetic acid bacteria grow as a surface of the vessels due to their aerobic nature and active motility.

Vinegar contains 4-8% acetic acid by volume.

Manufacture of vinegar into two steps:

1- Fermentation of sugar to alcohol (ethanol) - anaerobic process carried out by *Saccharomyces cerevisiae*.

2- Oxidation of alcohol to acetic acid- aerobic oxidation carried out by acetic acid bacteria of genus *Acetobacter aceti.*

Sugar $\longrightarrow$ Ethanol $\longrightarrow$ Vinegar

Backers Yeast Acetic acid bacteria

Practical experiments:

1* pH measure:

oH paper is a simple & easy but limited accuracy and is not suitable for colored solutions therefore prefer to use measuring devices.

2* Titrable acidity:

To measure percentage of ionized & non-ionized acids, unlike the pH reading which expresses the percentage of ionized acids only.

The titratable Acidity is a total amount of acid in the solution as determined by the titration using a standard solution of sodium hydroxide (NaOH) using the following formula.

Transfer (1 ml) of alcohol solution in 250 ml Erlenmeyer flask.

Add about 19 ml of distilled water and 12 drops of 10% Phenolphthalein as an indicator reagent.

3- Fill the burette with 0.1N NaOH Solution.

4-Titrate the mixture with 0.1N NaOH until the mixture starts to turn pinkish and stay pinkish, and then record the amount of NaOH used for titration.

$$\textbf{Titratable Acidity} = \frac{\text{ml of NaOH x Normality of NaOH x m. equivalent weight of acetic acid}}{\text{Weight of sample x Total titration volume}} \times 100$$

m. equivalent weight of acetic acid = 0.06005

Weight of sample = 1 gm

#Total titration volume = 20 ml (1 gm + 19 ml)