Sauerkraut fermentation

The word sauerkraut means Sour cabbage or acidic cabbage. Cabbage is the vegetable used in Sauerkraut preparation, which is a good source of ascorbic acid, vitamins, and minerals and possesses value for its salad and culinary properties. However, it is post-harvest losses are as high as 60 %. Fermentation has been used since the early days of civilization to preserve food materials and to develop newer products. Cabbage could be preserved as Sauerkraut, which is an acid fermented product.

It is a result of natural fermentation by bacteria indigenous to cabbage in the presence of 2-3 % salt. The fermentation yields lactic acid as the major product. The lactic acid, along with other minor products of fermentation gives sauerkraut its characteristic flavor and texture.

As no starter cultures are involved in this process, this is referred to as wild fermentation. The normal flora of the cabbage leaves is relied upon to include the organisms responsible for the desired fermentation, one that will enhance preservation and organoleptic acceptability. The floral succession is governed mainly by the pH of the growth medium. Initially, a coliform starts the fermentation. As acid is produced, an environment more favorable for *Leuconostoc* is quickly formed.

The coliform population declines as the population of the strain of *Lactobacillus* builds. As *Leuconostoc* is the heterofermentative lactic acid bacterium, much gas (CO_2) accompanies the acid production during this stage. The pH continues to drop, and a strain of Lactobacillus succeeds in the *Leuconostoc*. (Sometimes *Pediococcus* arises instead of *Lactobacillus*). The complete fermentation then involves the succession of

three major groups of genera of bacteria, a succession governed by the decreasing pH.

Addition of salt

Salting of the cabbage serves two major purposes. First, it causes as an osmotic imbalance, which results in the release of water and nutrients from the cabbage leaves. The fluid expelled is an excellent growth medium for the microorganisms involved in the fermentation. It is rich in sugar and growth factors. Second, the salt concentration used inhibits the growth of many spoilage organisms and pathogens. It does not obviously inhibit desired floral succession.

Cabbage is approximately 90 % water, and the salt is dissolved entirely in the water. The actual salt concentration (brine strength) experienced by the microorganisms in their aquatic milieu is around 2.8 %.Thorough and even distribution of the salt is critical. Pockets of low or high salt concentration would result in spoilage and /or lack of the desired fermentation.

Oxygen supply

Throughout the fermentation it is critical that oxygen is excluded. The presence of Oxygen would permit the growth of some spoilage organisms, particularly the acid-loving molds, and yeasts.

Temperature

The time required for the fermentation depends on temperature. A temperature of 21c° is preferred for the fermentation. If it is favorable, a period of 8-6 weeks will ordinarily sufficient. At the end of this time, the following changes are marked.

- The product will have acquired its typical aroma.
- All the fermentable carbohydrates will have been consumed.
- The acid content will have risen to between 1.85 and 2.2 % .
- The pH will be approximate to the range of 3.5 -3.7.

Materials required

- Fresh heads of cabbage
- Large knives
- Cabbage shredders
- Containers for shredded cabbage
- Balance
- NaCl (Commercial grade)
- Airtight containers (Plastic/glass)

Procedure

- Trim the cabbage heads, removing the outer leaves and all bruised or soiled tissue.
- Wash the trimmed heads thoroughly with tap water.
- Cut the heads in half, removing the hard, central core.
- Shred the cabbage with the cabbage shredder.
- Weigh the shredded cabbage. Mix in the salt such that a final concentration of 2.5 % is achieved. Complete, even mixing of the salt is highly critical.
- Pack the shredded cabbage into the containers, filling to approximately 75-80 % of total volume. Compress the mixture moderately while avoiding, crushing or bruising the cabbage tissue
- Close the container air tight
- Incubate at 24c° for 5-6 weeks

pH determination

Using pH paper, determine the pH of the undiluted juice sample. Add 10 ml undiluted juice sample to the Erlenmeyer flask. Add 10 ml of distilled water. Boil the flask for 1 minute to drive off the dissolved CO2. Cool and add 5 drops phenolphthalein. Titrate with 0.1 M NaOH, until a light pink color persists.

Using the following **formula,calculate** the percent lactic acid (the predominant nonvolatile acid expected in the sauerkraut fermentation).

$$\% \text{ Lactic acid} = \frac{\text{Titer value} \times \text{Normality of alkali} \times \text{Mill equivalent of lactic acid}}{\text{Volume of sample taken for titration} \times \text{wt. of the sample}} \times 100$$