

Culture Starter: Study and Comparison

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Introduction

Fermentation is a low cost and effective method of processing and preserving food. Numerous studies have shown the beneficial effects on health of fermented food, especially fermented vegetables such as sauerkraut or Kimchi. However, traditional fermentation is not well controlled. In fact, most fermented foods are produced spontaneously and their fermentation takes place with the indigenous flora of the vegetables. Unfortunately, this flora can contain moulds, yeasts or even pathogens, which may cause health risk. In order to control the fermentation and the innocuousness of the final product, mankind has developed starters composed of one or more microorganisms. In the scientific literature, many studies report the use of mixed cultures of lactic acid bacteria, but only a few specified the quality of the obtained sauerkraut. The purpose of this study was to compare the quality of sauerkraut using different methods of fermenting cabbage.

Material and Methods

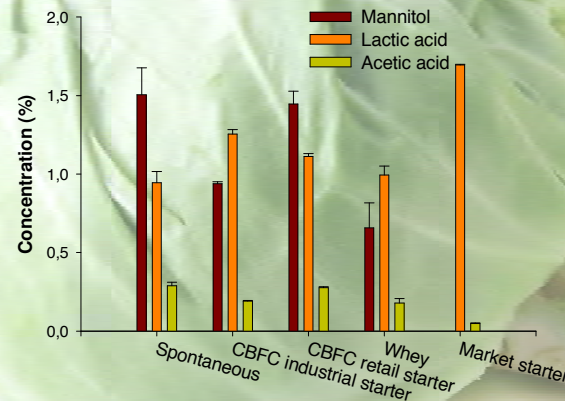
Fermentation: 2 kg of shredded cabbage were added to a brine solution (45g of salt) in a ratio of 3:1 and inoculated with a starter (CBFC's industrial or retail starter, or whey). The mixture was packed down well until the cabbage was submerged with brine. The fermentation pails were placed at 20°C during 7 days, then transferred to 4°C for 60 days. The results were then compared to a spontaneous fermentation using the same procedure, and to a fermentation with a widely available starter as instructed (referred to here as the market starter).

Analysis: microbiology analysis were made by enumerating different colonies of bacteria: lactic bacteria, *Leuconostoc*, moulds and yeasts. Chemical quantification were made on sugars, acids and alcohol. All results are represented as the means of 3 trials.

Results and Discussion

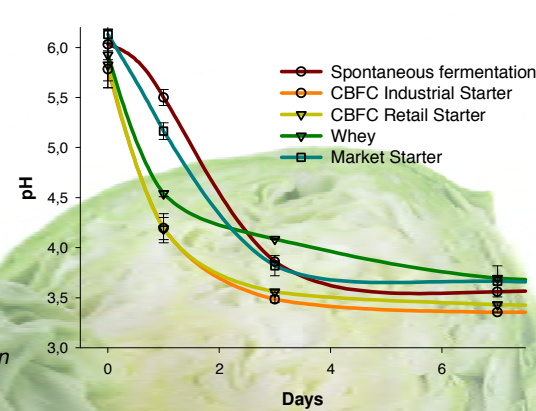
The first days of fermentation are crucial in order to obtain a safe product. In fact, the pH drop should be as quick as possible in order to eliminate pathogens, moulds and yeasts which are sensitive to low pH. In the case of the CBFC starters, the production of organic acids by the lactic bacteria decreased the pH rapidly in 1 day. For the other starters, the same pattern occurred but the bacterial growth and the acidification speed were delayed by 3 to 4 days and this can be responsible for the development of toxins.

Chemical Composition after Fermentation



CBFC starters are the only starters made with bacteria native from vegetables and dedicated to the fermentation of vegetables. Effectively, *Lb. plantarum*, *Ln. mesenteroides* and *Pc. acidilactici* used in CBFC starters were isolated from cabbage. In the case of a spontaneous fermentation, bacteria present on the cabbage are in a tough competition during the first days of fermentation and give unpredictable and unreproducible results. Concerning the whey and the market starter, both are composed of dairy bacteria; the results are not too bad, but the bacteria used are not appropriate for fermenting vegetables. Moreover, the whey starter can be responsible for the growth of pathogens, since it's a raw unpasteurised starter.

pH Evolution During the First Days of Fermentation



As reported by the food industry, a perfect sauerkraut should be crunchy and have a lactic/acetic ratio between 3 and 6. The production of mannitol by *Ln. mesenteroides* is essential to maintain the moisture of the sauerkraut and thereby retain its crispness. Moreover, mannitol is a sweetener that gives a less acid taste to sauerkraut. Unlike other starters, the market starter does not contain the appropriate bacteria to produce mannitol and has a lactic/acetic ratio over 25.

Conclusion and Reminder

In order to make a good sauerkraut, there are numerous parameters to control. Part of them are:

- bacteria mixture (strains, proportion)
- salt concentration (1.8 %)
- temperature
- procedure (packed well, submerged, ...)

All these parameters, combined with the use of CBFC starters (industrial or retail), resulted in a safer and superior final product.

Salt plays an essential role in the fermentation process and enhances the quality of the final product. In fact, salt creates osmosis, liberates the vegetables' sugars, encourages lactic acid bacteria rather than pathogens, and inhibits pectin enzymes to help avoid a mushy texture.

Finally, the use of an appropriate starter is reported to produce more bioactive components such as isothiocyanates in sauerkraut: results showed that the concentration of isothiocyanates was linked to the bacterial growth, specifically to the growth of *Lactobacillus*.

References

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