



MASTER BREWERS ASSOCIATION OF THE AMERICAS

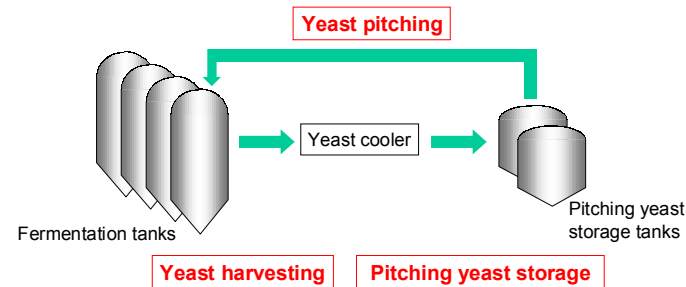
A VITALITY-ORIENTED YEAST MANAGEMENT IN SUNTORY KYOTO BREWERY WITH RECENT TECHNOLOGY

Atsushi Fujita, Nobuyuki Fukui, Osamu Takemura, Takeshi Yonezawa, Hiroshi Ikeda and Yoshi Kakimi, Suntory Ltd., Japan

Introduction

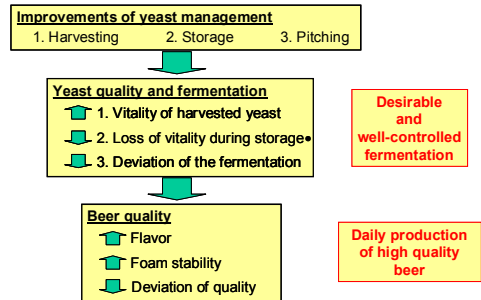
To produce high quality beer, good materials and vital yeast are essential. Moreover, the well-designed processes that draw the maximum possible use of them are indispensable. For the desirable and well-controlled fermentation, the total yeast vitality should be controlled at an equally high level in each fermentation. To achieve consistently high yeast vitality, we have revised our process, harvesting, storage and pitching of yeast.

Objects of this work



Summary

Our vitality-oriented yeast handling system greatly contributes to improved beer quality by achieving a desirable and well-controlled fermentation.

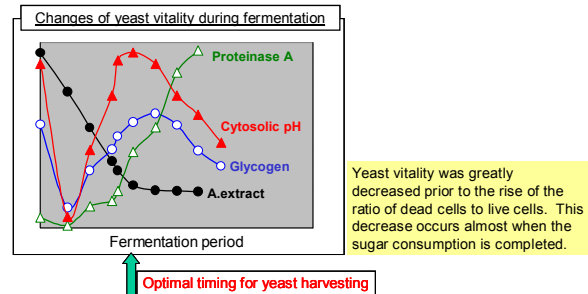


Indices for evaluating yeast viability and vitality (used in this work)

- Methylene blue staining
Conventional index to distinguish dead cells from live ones
- Glycogen contents of the cell
Correlated to the length of the lag-phase of growth
- Cytosolic pH
Correlated to the ability to assimilate nutrients and to the maximum cell number
- Amount of Proteinase A leaked from the cell
Indicator for the lysis of the cells and the improper sorting of proteins
Negatively correlated to the stability of beer foam
- Fermentative ability
Overall evaluation for the fermenting yeast

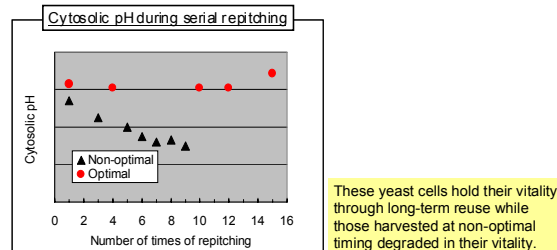
1. Yeast Harvesting : Harvesting yeast with high vitality

We examined the changes of yeast vitality in the process of fermentation with several indices and determined the optimal timing for harvesting yeast with high vitality.

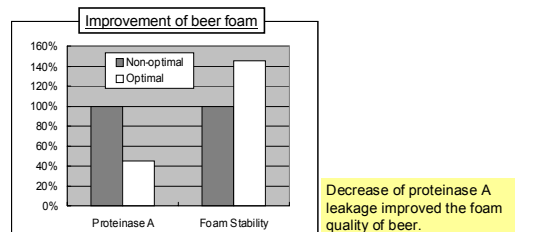


Yeast vitality was greatly decreased prior to the rise of the ratio of dead cells to live cells. This decrease occurs almost when the sugar consumption is completed.

Serial repitching of the yeast harvested at the optimal timing improves the yeast vitality and beer quality.



These yeast cells hold their vitality through long-term reuse while those harvested at non-optimal timing degraded in their vitality.

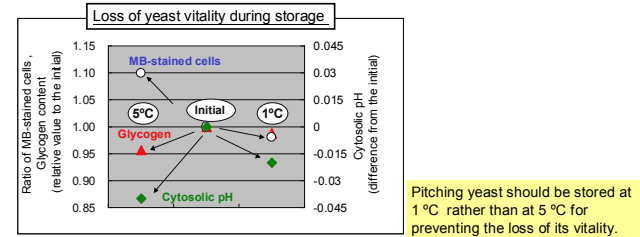


Decrease of proteinase A leakage improved the foam quality of beer.

Both yeast vitality and beer quality was successfully improved through the optimization of the timing for harvesting yeast.

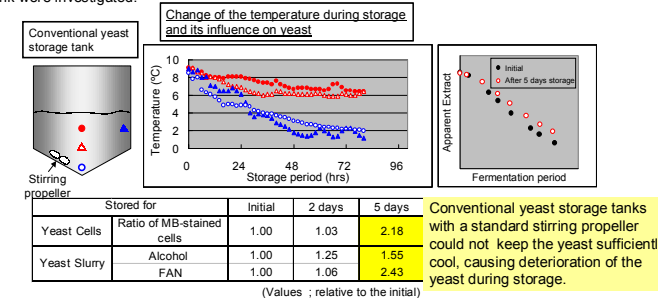
2. Pitching yeast storage : Holding its high vitality

Storage at 5 °C for 3 days deteriorates vitality of the yeast harvested at the optimal timing.



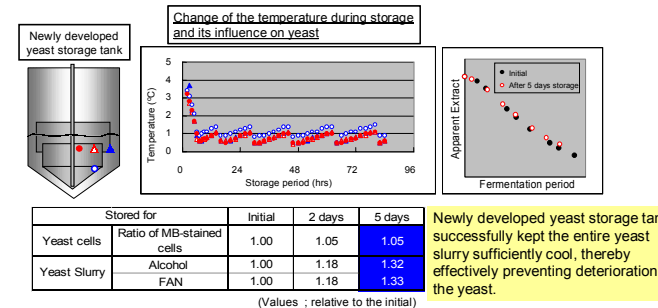
Pitching yeast should be stored at 1 °C rather than at 5 °C for preventing the loss of its vitality.

Change of the temperature and the quality of the yeast stored in a conventional yeast storage tank were investigated.



Conventional yeast storage tanks with a standard stirring propeller could not keep the yeast sufficiently cool, causing deterioration of the yeast during storage.

Change of the temperature and the quality of the yeast stored in the newly developed yeast storage tank with large mixing paddles were investigated.



Newly developed yeast storage tanks successfully kept the entire yeast slurry sufficiently cool, thereby effectively preventing deterioration of the yeast.

Our new yeast storage system with high cooling capacity successfully maintained the vitality of the yeast even through 5 days storage.

3. Yeast Pitching : Providing equal amounts of total vitality to each fermenter

Precise control of the pitching is essential to minimize the deviation of the fermentation performance among many tanks.

Determination of the amount of yeast to be pitched by cell counting

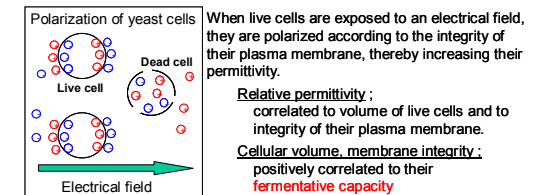
Based on its viability estimated with methylene blue staining

Disadvantages of this method

- Microscopic cell counting is needed prior to pitching (Off-line manual operation)
- Differences in vitality among non-stained cells are not taken into account when calculating the amount of yeast to be pitched.

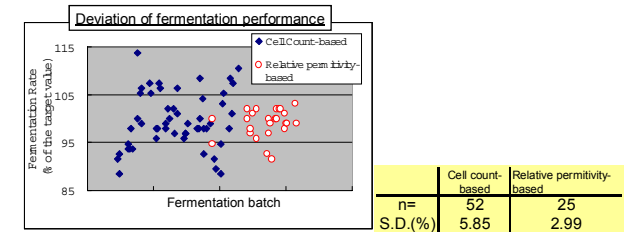
Not suitable for precise control of pitching

Determination of the amount of yeast to be pitched by dielectric monitoring



Total fermentative capacity (= total vitality) of yeast to be pitched to a fermenter can be calculated through the on-line monitoring of relative permittivity.

On-line dielectric monitoring and the automatic pitching control system were adopted by our breweries for precise control of pitching based on yeast vitality.



Deviation of the fermentation performance was successfully minimized by providing equal amounts of total vitality to each fermenter equipped with a dielectric monitoring system.