

## A Research Note

# Influence of Aeration Rate on Yeast Production in Sauerkraut Brine

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### ABSTRACT

The optimal rate of of aeration for production of food yeast (*Candida utilis*) in sauerkraut brine was found to be approximately 24 mM O<sub>2</sub>/1/h.

In sauerkraut manufacture, about 29% of the salted, shredded cabbage is discarded as brine (3). This discard is high in BOD (biochemical oxygen demand), total acid as lactic, and NaCl content. It presents a serious treatment problem. Several food yeasts have been shown to grow well in sauerkraut waste without adding nutrients or neutralizing the acids; *Candida utilis* grew most rapidly and gave the highest cell yields (2).

Since aeration plays an important role in the manufacture of yeast (5), the present study was undertaken to determine the effective aeration levels (the amount of oxygen dissolved in the solution) required for production of *C. utilis* NRRL Y-900 in sauerkraut brine.

### MATERIALS AND METHODS

Sauerkraut brine was obtained from a commercial sauerkraut factory; it contained the the following, expressed as milligrams/liter: BOD, 29,000; total acid as lactic, 16,100; Kjeldahl nitrogen, 1,390; total phosphorus, 208; NaCl, 28,500; pH 3.3. Experiments were done at 26 C in a 7-liter fermentor (New Brunswick Scientific Co.) containing 5 liters of sauerkraut brine and 10% (vol/vol) of a 24-h yeast culture. Dow Corning Antifoam A Spray was used to depress foam formation. Rates of effective aeration in the fermentor were measured by the sulfite oxidation method of Cooper et al. (1). Methods used to determine the 5-day BOD, yeast dry weight, total acid as lactic, Kjeldahl nitrogen, total phosphorus, and NaCl were described previously (3). All samples were prepared in duplicate and the reported data are average values.

### RESULTS AND DISCUSSION

Growth of *C. utilis* in sauerkraut brine as affected by rates of effective aeration is shown in Fig. 1. The optimal rate of aeration was approximately 24 mM O<sub>2</sub>/1/h. At aeration rates below 24 mM O<sub>2</sub>/1/h, the yield of yeast cells decreased sharply. Rates higher than 24 mM O<sub>2</sub>/1/h, however, did not give an appreciable increase in yeast yield. Wasserman and Hampson (5) reported that an effective aeration rate of 90 mM O<sub>2</sub>/1/h was required for maximal growth of *Saccharomyces fragilis* in whey. This variation is attributed mainly to differences in the composition of growth media and in the species of yeast used.

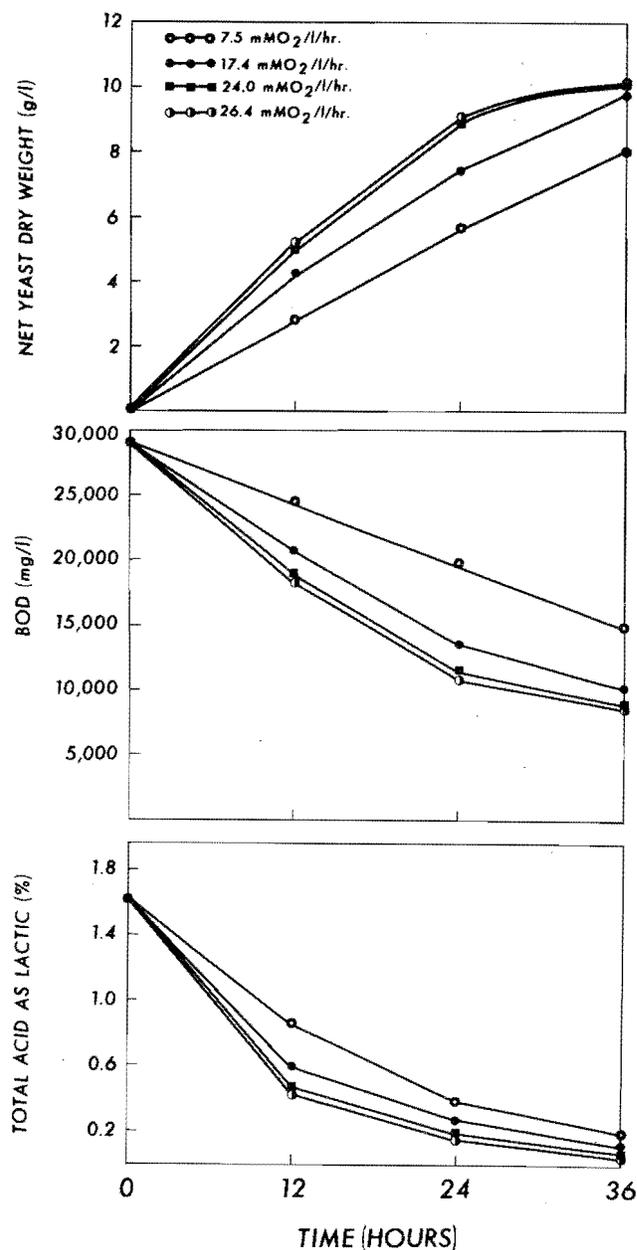


Figure 1. Effect of aeration on the growth of *Candida utilis* NRRL Y-900 in sauerkraut brine

Removal rates of the brine BOD and total acid as lactic by the yeast were also dependent on the rates of effective aeration (Fig. 1). As the effective aeration rate was increased, rates of BOD and total acid removal greatly increased. At the optimal aeration rate, Kjeldahl nitrogen and total phosphorus reductions were approximately 52 and 63%, respectively, in 24 h.

There was no appreciable influence of effective aeration on the protein content of the yeast. Thus, the amount of protein in dried yeast grown at the aeration rates of 7.5, 17.4, 24.0, and 26.4 mM O<sub>2</sub>/1/h was 45.5, 44.7, 46.3, and 46.4%, respectively. Singh et al. (4) have also noted no effect on the protein content of yeast due to aeration.

Obviously from results obtained in this work, aeration must be sufficient for maximal growth of *C. utilis* in sauerkraut brine and for most rapid removal of BOD and total acid.

### Preliminary Results on Ground Beef Survey

OTTAWA—Health and Welfare Minister Marc Lalonde today announced the first results of a national survey of the micro-biological quality of ground beef.

Of the first 897 samples of ground beef analyzed, taken from 180 stores in 5 provinces, 18 have been found to be contaminated with salmonella organisms. In all positive samples the level of contamination was low. Although salmonella organisms are readily destroyed at normal cooking temperature, their presence in raw food represents a potential health hazard because of the possibility of transferring such contamination to other food.

There were 7 stores in which positive samples were found.

Each of the stores involved were notified of the results obtained, and issued a warning. If positive samples are found on re-sampling their ground beef, further regulatory action will be taken, under the authority of the Food and Drugs Act. Re-sampling is now underway. Detailed inspection of all aspects of the operations of the retail stores in which positive samples have been found is being conducted, in order to determine if the contamination occurred at the retail level or was present in the beef as received by the retailers.

Provincial and municipal health agencies, which monitor food sanitation, storage and processing at the retail level, have been notified of the findings, in order that they also can initiate corrective action as considered appropriate.

### ACKNOWLEDGMENTS

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### REFERENCES

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The design of the study made it necessary to analyze more than the 1,000 samples on which the study was originally based. Therefore, staff of the Health Protection Branch currently are analyzing a total of 1,340 samples of ground beef, including hamburger, ground chuck, minced beef, minced round and meat-soya protein mixtures, taken from stores in each of the 10 provinces. Each sample is being examined for total bacterial content, salmonella, coliforms and staphylococci. Only the results for salmonella are as yet available for a significant number of samples, but information for the other measures of quality is being produced and evaluated as rapidly as possible.

As a result of the finding of salmonella organisms in some samples of ground beef, the survey is being expanded further in size and scope, to include a total of 2,000 samples, selected from a wider variety of retail outlets in each province. This will permit a more detailed assessment of the overall quality of ground beef on the Canadian market and provide basic information on which to develop proper legal standards for the microbiological quality of ground beef. Plans are being made to undertake a similar survey of prepared meats, such as sausage, bologna, etc.

A series of workshops for retail meat handlers is being planned by the Health Protection Branch to reinforce the importance of proper practices and procedures relating to meat sanitation.