COLLECTION OF PAPERS ON CO_2 AND CONTROL OF BLOATERS DURING CUCUMBER FERMENTATION*

The U.S. Food Fermentation Laboratory (USDA and NCAES, Raleigh, North Carolina) has studied the problem of bloater damage of fermented cucumbers for many years. Attached is a selected collection of papers which relate to reduction of bloater damage by controlling the fermentation and CO_2 of the brine.

Bloater damage has been related to many factors as demonstrated by the attached publications, and others from this Laboratory which may be consulted for a more thorough background of information. The problem areas responsible for bloaters may be categorized into:

I. Properties relating to the cucumber:
   1. Size, 2. Variety, 3. Mechanical injury, 4. Growing conditions
II. Brining conditions:
   1. Temperature, 2. Salt concentration, 3. Container geometry
III. Microbes active during the fermentation:
   1. Lactic acid bacteria, 2. Coliform bacteria, 3. Yeasts

The suggested procedure for the controlled fermentation process incorporates features designed to eliminate the defects of brine-stock pickles such as bloater damage. This procedure includes washing of the cucumbers, sanitizing, acidification, buffering, purging to reduce CO_2 with N_2 gas, and starter cultures of lactic acid bacteria (see no. 2). It is valuable to monitor the dissolved CO_2 in the brine. Nitrogen gas is recommended for purging CO_2 from the brine. The use of air and continuous pumping of the brine, particularly of "natural" fermentations may produce inferior, soft stock and should not be carried out. The evaluation of the brine stock for bloaters (see no. 1, bloater chart), firmness, color, and overall commercial acceptability should be recorded for each tank.

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*Prepared by Thomas A. Bell and Henry P. Fleming, Food Fermentation Laboratory, U.S. Department of Agriculture, Agricultural Research Service, Southern Region, P. O. Box 5578, Raleigh, North Carolina 27607, 1976.

PUBLICATIONS ATTACHED

1. BLOATER CHART. Etchells, J. L.; Bell, T. A.; Fleming, H. P.; Kelling, R. E.; and Thompson, R. L. Published and distributed by PPI, Inc., P. O. Box 31, St. Charles, IL, 1974.

2. SUGGESTED PROCEDURE FOR THE CONTROLLED FERMENTATION OF COMMERCIALLY BRINED PICKLING CUCUMBERS--THE USE OF STARTER CULTURES AND REDUCTION OF CARBON DIOXIDE ACCUMULATION. Etchells, J. L.; Bell, T. A.; Fleming, H. P.; Kelling, R. E.; and Thompson, R. L. Pickle Pak Sci. 3: 4-14, 1973.

3. FACTORS INFLUENCING BLOATER FORMATION IN BRINED CUCUMBERS DURING CONTROLLED FERMENTATION. Etchells, J. L.; Fleming, H. P.; Hontz, L. H.; Bell, T. A.; and Monroe, R. J. J. Food Sci. 40 (3): 569-575, 1975.

4. PURGING OF CO_2 FROM CUCUMBER BRINES TO REDUCE BLOATER DAMAGE. Fleming, H. P.; Etchells, J. L.; Thompson, R. L.; and Bell, T. A. J. Food Sci. 40 (6): 1304-1310, 1975.

5. BLOATER FORMATION IN BRINED CUCUMBERS FERMENTED BY LACTOBACILLUS pLANTARUM. Fleming, H. P.; Thompson, R. L.; Etchells, J. L.; Kelling, R. E.; and Bell, T. A. J. Food Sci. 38 (3): 499-503, 1973.

6. CARBON DIOXIDE PRODUCTION IN THE FERMENTATION OF BRINED CUCUMBERS. Fleming, H. P.; Thompson, R. L.; Etchells, J. L.; Kelling, R. E.; and Bell, T. A. J. Food Sci. 38 (3): 504-506, 1973.

7. DETERMINATION OF CARBON DIOXIDE IN CUCUMBER BRINES. Fleming, H. P.; Thompson, R. L. and Etchells, J. L. Assoc. of Offi. Anal. Chem. 57 (1): 130-133, 1974.

8. ADVISORY STATEMENT: QUICK METHOD FOR ESTIMATING CO_2 IN CUCUMBER BRINES. Fleming, H. P.; Thompson, R. L. and Bell, T. A. Published and distributed by PPI, Inc., P. O. Box 31, St. Charles, IL, 1974.

9. BLOATER FORMATION BY GAS-FORMING LACTIC ACID BACTERIA IN CUCUMBER FERMENTATIONS. Etchells, J. L.; Borg, A. F. and Bell, T. A. Appl. Microbiol. 16: 1029-1035, 1968.

10. GASEOUS PRODUCTS OF CUCUMBER PICKLE FERMENTATIONS. Veldhuis, M. K. and Etchells, J. L. Food Res., 4: 621-630, 1939.