MICROBIOLOGICAL PROBLEMS IN THE SAMPLING AND STORAGE OF RAW ONIONS AND THE EFFECT OF HYPOCHLORITE TREATMENT ON QUALITY OF THE DEHYDRATED PRODUCT

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V. Summary and Conclusion

Sampling technique and bacterial inhibition by ground onion were two problems faced in making accurate microbiological analyses of onion samples. Different methods of sampling were tested. Slicing the onion through a centrifugal slicer, mixing well, passing the onions through the slicer a second time, and mixing well again was found to be a satisfactory procedure for obtaining a representative sample. It was found that a sample size of six pounds, randomly selected, with duplicate 100 g double sliced sub-samples taken for blending was appropriate. When total bacterial population of onion was determined according to standard methods, a bacteriostatic effect was encountered. This was true for different types of raw onion as well as for dehydrated onion. The plate counts increased from zero at low dilution to high numbers at increased dilutions and then to zero again with further dilution. Such a situation casts extreme doubt on any results obtained. It is known from the work of several investigators that the vapor and juice of fresh onions have a germicidal effect on certain microorganisms. A series of chemical compounds with redox reaction potential were tested for their effect on organoleptic pungency of onion homogenates. The results of this test showed that \( \text{K}_3\text{Fe(CN)}_6 \), KI0\(_3\) and K\(_2\text{SO}_3\) added to the blending water were able to eliminate pungency. Potassium sulfite was chosen for further study. Nearly quantitative recovery of inoculated B. subtilis was obtained when 0.1, 0.5, 1.0 or 1.6% solution of K\(_2\text{SO}_3\) was used in blending. At a concentration of 3.2% K\(_2\text{SO}_3\), however, some of the inoculated B. subtilis was inhibited. As a result of this work, the standard TPC procedure was performed by blending one part of onion with three parts of 1.0% sulfite solution. It
was also shown that sulfite allowed complete recovery of coliform bacteria.

There are two main objectives in storing onions; first to hold over part of the seasonal surplus, and second to extend the processing season. Since the main objective of this work was concerned with the microbial quality of the product, eight different storage conditions were investigated as influencing the number of microorganisms in sound and bruised onions after three weeks' storage. The primary storage variables were room temperature versus 34°F and moving air versus still air. Total plate count and percent spoiled and sprouted onions were recorded to determine the effect of these storage variables on the growth of microorganisms. These were combined into an expression termed the Quality Factor (Q.F.). The smaller the magnitude of the Q.F. the better the quality of the onion. The data showed that 34°F and moving air was the best storage condition, for even initially bruised onions kept well under these conditions. Statistical analysis of the Q.F. results showed that the main effects, room temperature versus 34°F and sound versus bruised onion, were significant at the 1% level. No significant difference was found between moving and still air. Since the onion is a root crop, all types of soil organisms are to be found in fresh onion. Chlorination was studied as a means for reducing the initial contamination and thereby improving microbial quality of the dehydrated product. Several chlorine concentrations at three different pH levels and three immersion times were tested on the percent survivors of bacteria in onion. Chlorine solutions at pH 6.0 were more effective than at pH 7.2 or higher, which was in agreement with the theory of germicidal efficiency of chlorine. When a solution of 100 ppm at pH 6.0 was used, about 5% of the bacteria survived. When the concentration was increased
to 200 ppm at the same pH about 1% of the initial count survived. A statistical analysis showed that both pH and concentration were significant at the 5% level. When the product later was dried another tenfold reduction of TPC took place. Since pungency is one of the criteria of dehydrated onions, the treatment effect on the pungency was considered.

Using the chemical method for pungency, the sample treated with 200 ppm at pH 6.0 showed a decrease of about 30% as compared to that of the untreated control. The organoleptic pungency evaluation showed a decrease from 7.7 to 3.4 for the treated sample. If a more pungent onion were used for raw material, a 30% reduction in pungency might not remove this product from classification as a commercial item. Statistical analysis on the data of chemical pungency showed that chlorine treatment of 100 and 200 ppm at pH levels 7.2 and 6.0 was not significant, even at the 5% level. Statistical interpretation of the organoleptic pungency, however, indicated that under the same treatment conditions, the main effects pH and concentration were significant at the 1% level.

The effect of chlorine treatment on the color of the dehydrated product was also studied. The Optical Index of extracted color was compared with standards set up by the American Dehydrated Onion and Garlic Association. The untreated samples and those treated with 100 ppm at pH 7.2 were of grade C; the remaining samples were of grade A. Statistical analysis performed on the results of treatment on color showed that the main effects pH and concentration were significant at the 5% level.
# Table of Contents

I. Introduction ........................................................................................................... 1

II. Review of Literature ............................................................................................ 5

A. The onion ................................................................................................................. 5
B. Sampling for microbiological evaluation .............................................................. 5
C. Storage of raw onions ............................................................................................ 7
D. Chlorine solutions .................................................................................................. 10
E. The germicidal action of chlorine ........................................................................... 12
F. Pungency and antimicrobial principal in onion ..................................................... 15
   1. Pungency .............................................................................................................. 15
   2. Antimicrobial principle ......................................................................................... 17

III. Materials and Methods ......................................................................................... 19

A. Raw material ......................................................................................................... 19
B. Storage conditions .................................................................................................. 19
C. Preparation of raw onions for storage .................................................................... 26
D. Microbiological sampling ....................................................................................... 26
   1. Variability in the individual onion ................................................................. 28
   2. Using four sets of 4 onions .............................................................................. 28
   3. Using a one gallon size blender ...................................................................... 28
   4. Comparison of centers with outer scales ....................................................... 30
   5. Using a meat grinder ......................................................................................... 31
   6. Use of a centrifugal slicer ............................................................................... 31
   7. Sampling for storage study ................................................................................ 32
   8. Sample Calculations ......................................................................................... 32
      a. Total Plate Count (TPC) ............................................................................... 32
      b. Quality Factor (Q.F.) .................................................................................... 33
E. Antimicrobial principle in onion ................................................................ ........ 33
   1. Sensory pungency of onion homogenate ...................................................... 33
   2. The pH and organoleptic pungency of onion homogenates .......................... 34
   3. Effect on E. coli, A. aerogenes and E. subtilis ............................................. 34
   4. Effect on bacteria native to onion .................................................................... 35
   5. Methods of overcoming bacteriostatic action ............................................. 35
   6. Activity during blending and plating .............................................................. 35
   7. Bacteriostatic effect of different types of raw onions .................................... 36
   8. Bacteriostatic effect of dehydrated onion ...................................................... 36
F. Chlorination of raw onions ................................................. 36
G. Dehydration of onion ..................................................... 37
H. Bacteriological total plate count ....................................... 40
I. Evaluation of dehydrated onion ......................................... 40
   1. Color measurement of powdered onion .................................. 40
   2. Chemical pungency .................................................... 41
   3. Organoleptic pungency ................................................ 43
J. Free available chlorine determination .................................. 44
   1. A color reaction between chlorine and O-Tolidine .............. 44
   2. The Starch-Iodide method ............................................. 45
K. Statistical Methods ..................................................... 45

IV. Results and Discussion ................................................ 47

A. Microbiological sampling ................................................ 47
B. Antimicrobial principle in onion ........................................ 61
   1. Use of vacuum to remove antimicrobial pungency .................. 64
   2. Effect of chemicals on organoleptic pungency ..................... 64
   3. Evaluation of redox compounds for overcoming the bacteriostatic effect of onion ........................................ 65
   4. The pH and pungency of onion homogenates with different amounts of sulfites ........................................ 65
   5. Bacteriostatic effect of onion on E. coli and A. aerogenes and the use of sulfites as inhibitor ......................... 68
   6. Use of sulfites with B. subtilis inoculated onion homogenates .................................................... 71
   7. Bacteriostatic effect of different types of raw onions and use of sulfite for overcoming it ...................................... 74
   8. Bacteriostatic effect of dehydrated onions and the use of sulfite for overcoming it ........................................ 74
C. Storage studies of raw onions ........................................... 83
   1. Total plate counts ..................................................... 84
   2. Quality Factor ........................................................ 88
   3. Summary of quality data ............................................... 89
   4. Statistical Analysis ................................................... 102
D. Chlorination studies ..................................................... 106
   1. The effect of hypochlorite on the survival of microorganisms in raw onions without adjusting the pH ..................... 106
   2. The effect of hypochlorite concentration at pH 7.2 .............. 107
3. The effect of pH of hypochlorite solutions on survival of microorganisms in raw onion.......................... 111

4. Dehydration of onions washed with hypochlorite solutions................................. 115

5. Effect of chlorine pre-treatment on pungency of dehydrated onion......................... 120
   a. Chemical pungency.................................. 120
   b. Organoleptic pungency.............................. 123
   c. Summary of pungency data.......................... 127

6. Room temperature storage of dehydrated onions.............................................. 127

7. Effect of chlorine treatments on the color of dehydrated onion.......................... 133

V. Summary and Conclusion................................................................. 137

VI. Bibliography................................................................. 140

Vita................................................................. 145
VI. Bibliography


