

PRELIMINARY STUDY OF CORRELATION OF pH AND QUALITY OF SHUCKED PACIFIC OYSTERS

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ABSTRACT

Stored shucked Pacific oysters decreased in pH from 6.4 to 6.0 as quality changed from fresh to fair. A pH of 5.9 or less indicated that oysters were inedible.

In order to obtain a chemical index for the quality or freshness of commercially shucked Pacific Coast oysters, a preliminary study was made to determine the possible application of pH measurements. Work of this nature had already been conducted by Hunter and Linden^{1/} who found a definite relationship between the pH of the liquor from Atlantic Coast oysters and their freshness. The hydrogen ion concentration or pH of the oyster liquor increased during the process of spoilage regardless of the temperature of storage or bacterial count. The authors, using Potomac River oysters, found that from a pH 6.1 to 5.6 the oysters changed from good to stale in quality; from pH 5.3 to 4.9 from stale to sour or putrid; and at less than pH 5.0 the oysters were in an advanced stage of putrefaction.

Baldwin, Puncochar, and Pottinger,^{2/} some years later, repeated some of these studies. Their tests were made with the ground oyster meats as well as the oyster liquor. The original pH of the liquor was higher than that for the oyster meats; however, near the end of the storage period these values tended to be equal. They found, using East Coast oysters, that: at pH 6.2 to 5.9 oysters were in a good condition, at pH 5.8 in an "off" condition, pH 5.7 to 5.5 in musty condition, and pH 5.2 and lower the oysters were sour.

In the following preliminary work with Pacific oysters, an attempt was made to determine whether or not a set of pH standards could be prepared for these oysters and to determine if any correlation exists with the results of work with East Coast oysters.



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^{1/}Hunter, A. C. and Linden, B. R. The Investigation of Oyster Spoilage, American Food Journal 18, No. 519, 537-8 (1933).

^{2/}Baldwin, W. H.; Puncochar, J. F.; and Pottinger, S. R. Some Preliminary Studies on the Relative Value of Methods for Indicating Quality of Shucked Oysters. U. S. Fish and Wildlife Service Bulletin F.I. 2468-K.

Experimental Procedure

These tests were conducted in the field at a West Coast shellfish packing plant, using the facilities of the Fish and Wildlife Service mobile laboratory. The oysters were obtained directly from the packing line and represent "run of the mill" samples as no attempt was made to separate the various grades. These oysters, therefore, had received the usual commercial shucking, washing, and blowing.

After the initial pH measurements had been made, the oysters were repacked in one-half pint waxed ice cream cartons and placed in storage at 32° to 34° F. Organoleptic observations for odor and flavor and pH tests were made at periodic intervals during storage.

For the pH determination, three or four oysters were ground in a Waring Blendor and warmed to room temperature by alternately grinding the sample and warming the Blendor in a water bath to insure a thoroughly ground sample at the same uniform temperature. The pH determination was made on this ground sample using a Beckman model G pH meter. Three separate determinations were made for each test.

Preliminary tests in which the pH values of the surface, interior, and the ground oysters were studied, indicated that a more uniform sample and more uniform results were possible throughuse of the ground oyster samples at room temperature.

Discussion

Organoleptic observations and pH tests were made with two separate lots of oysters. The results are summarized in Table 1.

Table 1 - Comparison of pH Determinations and Organoleptic Examinations of Shucked Oysters Stored at 32°-34° F.

| S E R I E S I | | | S E R I E S II | | |
|---------------|------------|------------------------------------|----------------|------------|-------------------------------|
| Days Stored | Average pH | Condition of Oysters | Days Stored | Average pH | Condition of Oysters |
| 0 | 6.39 | Fresh | 0 | 6.39 | Fresh |
| 2 | 6.27 | Good | 2 | 6.08 | Good |
| 6 | 6.14 | Slightly strong, but good | 4 | 6.03 | Fair |
| 9 | 5.93 | Fair, but edible | 6 | 6.01 | Slightly stale, but edible |
| 11 | 5.87 | Stale | 8 | 5.88 | Stale and almost inedible |
| 13 | 5.92 | Very stale, and almost inedible | 10 | 5.90 | Stale and inedible |
| 15 | 5.89 | Slightly putrid and inedible | 13 | 5.74 | Very stale |
| 17 | 5.73 | Putrid | 15 | 5.75 | Slightly putrid |
| 20 | 5.83 | " | 17 | 5.69 | " " |
| 22 | 5.73 | " | 19 | 5.80 | Putrid |
| 24 | 5.66 | " | 21 | 5.60 | " |
| 26 | 5.85 | " | 23 | 5.58 | " |
| 28 | 5.63 | " | 24 | 5.70 | " |
| 30 | 5.55 | " | | | |

The original pH value of the oysters may show some variation. For example, the pH of the original sample in Series I varied from 6.42 to 6.36 and in Series II from 6.48 to 6.30. Results in the Table represent the average of three or four individual tests.

The pH of the original samples averaged 6.39. The value decreased as storage continued to a pH of 6.0 at which point the oysters were considered to be in only

fair, but edible, condition. At pH 5.90 the oysters were considered stale and proceeded to the putrid stage at about this same value. Below pH 5.90 the oysters continued on to advanced stages of putrefaction. After the oysters had become stale, the pH values tended to vary considerably from sample to sample and from day to day.

From these very limited data, the following values were derived showing the pH ranges for the various organoleptic observations:

From pH 6.4 to 6.0 the oysters changed from a fresh to a fair but edible condition

pH 6.0 to 5.9 from stale to slightly putrid

pH 5.9 and lower from slightly putrid to advanced stages of putrefaction

The development of an objective test to indicate the quality of shucked oysters is important. Packing plants could make freshness tests on oysters as received at the plant and the future keeping quality of each lot could then be determined. Oysters of limited keeping quality would be used only for local consumption; the others for markets at points a greater distance from the packing plants. Buyers could determine the freshness of oysters as received at distant markets. Of particular value would be the use by the Army Quartermaster Corps. Specifications could be set up for purchasing oysters. Organoleptic observations could be supplemented with chemical tests for freshness, allowing for a more suitable basis for examination of quality of fresh oysters.

The results in Table 1 indicate that pH measurements may possibly serve as an objective index of the quality of commercially shucked Pacific oysters. Obviously, however, many phases of the problem, other than those briefly discussed here, are yet to be considered. These include:

1. A more thorough study on the value of the pH of surface and liquor
2. More detailed study of the pH changes on storage
3. Effect of washing and blowing of the oysters
4. Variation in pH from oyster to oyster
5. Variation in pH of oysters from one part of a bed to another, from bed to bed, and from season to season

