Evaluation of Clorpectin WCS-50 as a Bactericidal Wash for Crab and Oyster Meats

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Ever since Pasteur showed that spoilage was due to microorganisms, food preservation has been primarily concerned with finding methods for reducing the microbial populations.

In order to extend the edible life of shellfish, its bacterial contamination must be reduced to levels sufficiently low to prevent their metabolic products from subverting these foods before they are consumed.

Shellfish food items receive a notorious amount of handling in preparation for market. This can, and in many instances does, debase an otherwise sound product. A supplementary protective rinse or wash before packaging might contribute much toward bacterial reduction. The relatively simple processing techniques employed in the industry lend themselves to the institution of such additional treatment without imposition of bottleneck or hardship. Accordingly, many chemicals have been applied to seafoods in order to reduce or, in some instances, mask microbial contamination. To date, however, for one or more reasons, only a small number are legally available.

As a result, the seafood industry is ever alert for suitable chemical agents that will obtain the necessary microbial destruction, yet be safe for human consumption.

Several recent publications in clinical journals have reported that Clorpectin\(^1\) WCS-90 approaches the "ideal germicide." Its indicated nontoxic, nonirritating characteristics prompted the writer to evaluate this agent for possible application to crab and oyster meats—two items known for extremely rapid bacterial deterioration.

Among the clinical reports was that of Zwerling (1955) who noted that, from an unselected group of 642 otolaryngologic (ear, nose and throat) patients treated with an 0.2 per cent aqueous solution of Clorpectin WCS-90, 477 or 74.2 per cent showed decided improvement with no untoward side effects.

When used strictly according to specifications, Lattimer (1955) reported it to be an effective germicide for tuberculous cystitis caused by \textit{Mycobacterium tuberculosis}. Swank (1955) reported that "the speed of its germicidal action and the completeness of the spectrum with the absence of toxicity, irritation or sensitization brings Clorpectin close to the goal of the ideal antiseptic for preoperative skin preparation." He recommended a 0.2 per cent solution for general application and a 0.5 per cent solution in the presence of organic debris.

O'Connor (1955) claimed "dramatic" improvement for 24 patients with intractable chronic interstitial cystitis after irrigation with 0.2 per cent Clorpectin. This indicated desirable attributes for its use with food.

\textit{In vitro} virucidal activity was reported for Clorpectin by Sanders and Soret (1955) who obtained complete inactivation of the Lansing poliomyelitis virus at a concentration of 0.2 per cent.

de Almeida (1953) reported on \textit{in vitro} tests with Clorpectin WCS-90 and found it to be bactericidal for \textit{Streptococcus pyogenes}, \textit{Streptococcus faecalis}, \textit{Bacillus anthracis}, \textit{Corynebacterium diphtheriae}, and strains of \textit{Salmonella}, \textit{Shigella}, \textit{Proteus}, \textit{Brucella}, \textit{Escherichia}, and \textit{Aerobacter}. Strains of several of these genera commonly contaminate crab and oyster meats.

The several reagents bearing the trade designation Clorpectin are derivatives of monoxychlorosines which liberate active chlorine as hypochlorous acid. Approximately 25 per cent of the formulation consists of the Clorpectin, which is a hydrocarbon composed of a chain of approximately 14 carbons containing an OCl group linked to an end carbon atom. In addition, a sulfonate group is attached at a point along the chain to increase the hydrophilic nature of the compound. The remaining 75 per cent of the formulation is made up of buffers and stabilizers that sustain the action of the liberated hypochlorous acid.

\textbf{Experimental}

For tests with crabmeat, Clorpectin WCS-50 (food grade), a fairly free-flowing, water-soluble, white powder was added to tap water. To prepare concentrations of 0.14, 0.28 and 0.56 per cent, respectively, 1.4, 2.8 and 5.6 were added to 1-L quantities of water. For the tests with crabmeat, only 0.28 per cent Clorpectin was used. The oysters, however, were subjected to all three concentrations.

\(^1\) Presented at the 13th General Meeting of the Society for Industrial Microbiology, Storrs, Connecticut, August 26 to 30, 1956.
\(^2\) Guardian Chemical Corporation, Long Island City, New York.
Fresh picked meat of the blue crab (Callinectes sapidus Rathbun) was obtained from commercial crab houses and our laboratory. From results of the initial plate counts on the untreated samples, the commercial samples were arbitrarily designated "high" and "moderate" count and the lab samples were designated "low" count. Seventy-five-gram samples of the meat were placed on 14 x 14 squares of cheesecloth, which were then appropriately folded to prevent the meat from escaping into the treatment bath.

The meat-filled cloths were placed into 1-L quantities of the Clorpactin solutions for periods of up to 30 min. During this time, they were continually agitated in order to facilitate dispersion of the Clorpactin throughout the meat particles.

At the end of each test period, a sample was placed in a sterile, chilled blender containing 75 ml of sterile, chilled, distilled water. After a 3-min blending period, 10-fold serial dilutions were made. One-milliliter portions of the appropriate dilutions were plated in nutrient agar Difco (pH 6.8) and incubated at 23 C ± 2 for 48 hr; bacterial plate counts were made at that time.

The procedure for oysters varied somewhat to suit the product.

Samples of oysters (Crassotrea virginica) shucked in their own liquor were obtained from commercial oyster houses.

Sufficient Clorpactin WCS-50 to achieve the desired concentration was added directly to a L of oysters shucked in their own liquor; additional water was not added. A liter of tap water (30 to 33 C) was added to a similar group of shucked oysters and this was made up to concentration with Clorpactin. Both groups were agitated continually in an attempt to insure adequate contact between the oyster meat and the Clorpactin.

At each test period, flamed forceps were used to remove six oysters to a blender for maceration. Dilutions and plate counts were carried out as described for crabmeat. However, as the moisture content of oysters is sufficiently high to yield a smooth homogenate, additional water was not required.

**RESULTS AND DISCUSSION**

The crabmeat data presented in figure 1 represent several trials that varied slightly. It may be seen that a 0.28 per cent Clorpactin solution was not sufficiently bactericidal to reduce the contamination to levels permissible by law. It was apparent that the heavier the initial contamination the larger the reduction obtained. Furthermore, the major reductions were apparently obtained during the initial 2 min of treatment. The subsequent 28 min, in all instances, contributed only slight additional increases.

"High"-count meat had its population diminished 91.6 per cent in 2 min, or approximately 99 per cent of its total reduction. "Moderate"-count meat obtained a 58 per cent reduction in the initial 2 min, or 78 per cent of its total reduction. With "low"-count meat, 70 per cent of the reduction was obtained in the initial 2 min of contact.

Reduction patterns of a similar nature were observed with the tap-water controls. Although distinct reductions were obtained by simple washing, the superiority of Clorpactin was evident.

Because of the heavy chlorine-like odor evolved in the treatment bath, additional concentrations of Clorpactin were not studied until organoleptic evaluations of the 0.28 per cent treated meat were completed.

Clorpactin treated crabmeat was packed in 8-
oz friction-top cans and placed in storage at 1 to 4 °C. At 12-hr intervals samples were removed for organoleptic evaluation. After 2 days, the "high"-count product was putrid. After 5 days, our "panel of experts" described both the "moderate" and the "low"-count meat as smelling heavily of laundry bleach and having a bitter taste. For this reason, no further testing was performed with crabmeat. The chlorine-like odor would preclude its sale. It may be of additional interest to regulatory agencies that an unsound product could not be rehabilitated.

The clinical reports indicated that Clorpactin buffered itself at a pH of approximately 6.7 in distilled water. This investigation employed the tap water that would be available in the commercial crab and oyster houses in this area; it maintains a pH of 8.5 and has an extremely high bicarbonate content. Thus, the Clorpactin bath obtained an initial pH of 7.1, which increased to 7.4 after 30 min of contact with crabmeat.

Holwerda (1928) demonstrated, for hypochlorites, that as the pH increased from 5.0 to 7.0 the per cent of undissociated hypochlorous acid dropped 20 per cent. Since the principal active agent of Clorpactin is hypochlorous acid, reductions in its concentration through pH activity might be expected to reflect on the bacterial population; this may be seen in the depressed reductions with increased contact time and rising pH.

In addition, the water temperature of 30 to 33 °C contributes to losses in available chlorine. Loveless (1934) showed that available chlorine decreased as the temperature increased from 21 °C.

The large amounts of organic material present in the bath also abet the loss of available chlorine. This has been demonstrated by Prucha (1927), Faber (1947) and Johns (1948). They concluded that organic material will absorb and neutralize a chlorine type of bactericide. Thus, the factors of pH, temperature, tap water, organic matter and chemical concentration could well have contributed to the weak activity of Clorpactin.

Before proceeding with a study of Clorpactin-treated oyster meats, samples were immersed in a 0.28 per cent solution to determine the influence on odor and taste. As no untoward odors or tastes were discernible after the first 12-hr storage period, the oyster meats were subjected to Clorpactin treatment at three concentrations.

Figure 2 shows the bacterial reductions obtained for oysters, with concentrations of 0.14, 0.28 and 0.56 per cent. The upper line of each pair indicates Clorpactin-treated oysters shucked in their own liquor.

That is, the appropriate amounts of the chemical required to obtain the particular concentration were added directly to the oysters without benefit of additional water. The lower line of the pair represents oysters shucked into tap water and then brought to concentration with the requisite amounts of Clorpactin.

An increase in population is seen after a small initial reduction at 0.14 per cent; 0.28 per cent gave larger initial reductions, but it, too, increased subsequently. It was evident that only the 0.56 per cent concentration secured the progressive reduction necessary for prevention of early deterioration.

The upper lines of the pairs showed the expected smaller reductions with oysters in their own liquor only. Lack of adequate contact between the Clorpactin and bacteria, necessary for substantial reductions, was apparently prevented.

In the case of curves B and B' (0.28 per cent Clorpactin), a sharp reduction in the first 2 min is followed by a rise in bacterial numbers greater than the 0.14 per cent treated sample. This may be explained by the larger initial population of the "B" sample and their recovery from the bacteriostatic effects of the 0.28 per cent concentration. It may be inferred that, under the conditions of the test, bactericidal conditions were

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4 The evaluations were performed by seven men and women native to Maryland's Eastern Shore with years of seafood experience.

5 This is lukewarm, as indicated by Zwerling.
obtained only by the concentration of 0.56 per cent Clorpactin.

As with crabmeat, the factors acting to neutralize the action of Clorpactin appear to be operative. In addition, the jelly-like proteinaceous film enveloping the oyster doubtless hinders penetration and binds much of the available chlorine. Thus, it required 0.56 per cent to produce the desired reductions.

Even though Clorpactin does not appear, by virtue of this study, to be a "remarkable" bactericide for food, it does offer a means of reducing the bacterial flora of oysters to within legal tolerances.7

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SUMMARY

Crab and oyster meats were immersed in solutions of Clorpactin WCS-50. Substantial reductions in the bacterial populations of shucked oyster meats were obtained by a concentration of 0.56 per cent. This treatment cannot be employed successfully to crabmeat, as the chlorine-like odor and bitter taste cling to it for periods sufficient to prevent its sale.

REFERENCES


7 Since this work has been completed, trials on a commercial scale have been carried out with marked success. Reductions in bacterial numbers similar to those herein reported have been obtained.