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REDUCTION OF CURD IN CANNED SALMON PREPARED FROM FROZEN FISH

Part I - Use of Tartaric - Acid and Sodium - Chloride Brine Dips

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ABSTRACT

Large amounts of proteinaceous curd frequently form on the surface of the canned product prepared from frozen salmon.

Dipping thawed red-salmon and coho-salmon steaks for 1 minute in a 5-percent solution of tartaric acid before canning effectively reduced curd formation. Visual examination indicated that the surface protein was coagulated by the action of the tartaric-acid solution. This tartaric-acid treatment tended to prevent the fading of color in red salmon during canning but slightly altered the shade of color to an orange-red. This slight color change was not objectionable. Steaks treated with the tartaric-acid solution did not stick to the can after processing as did untreated steaks or brined steaks.

Brining thawed salmon steaks before canning resulted in some reduction in curd formation but was not as effective as was the tartaric-acid dipping.

INTRODUCTION

During the past several years, the number of freezerships operating in Alaskan waters has increased considerably. Salmon frozen on these ships are deliver-

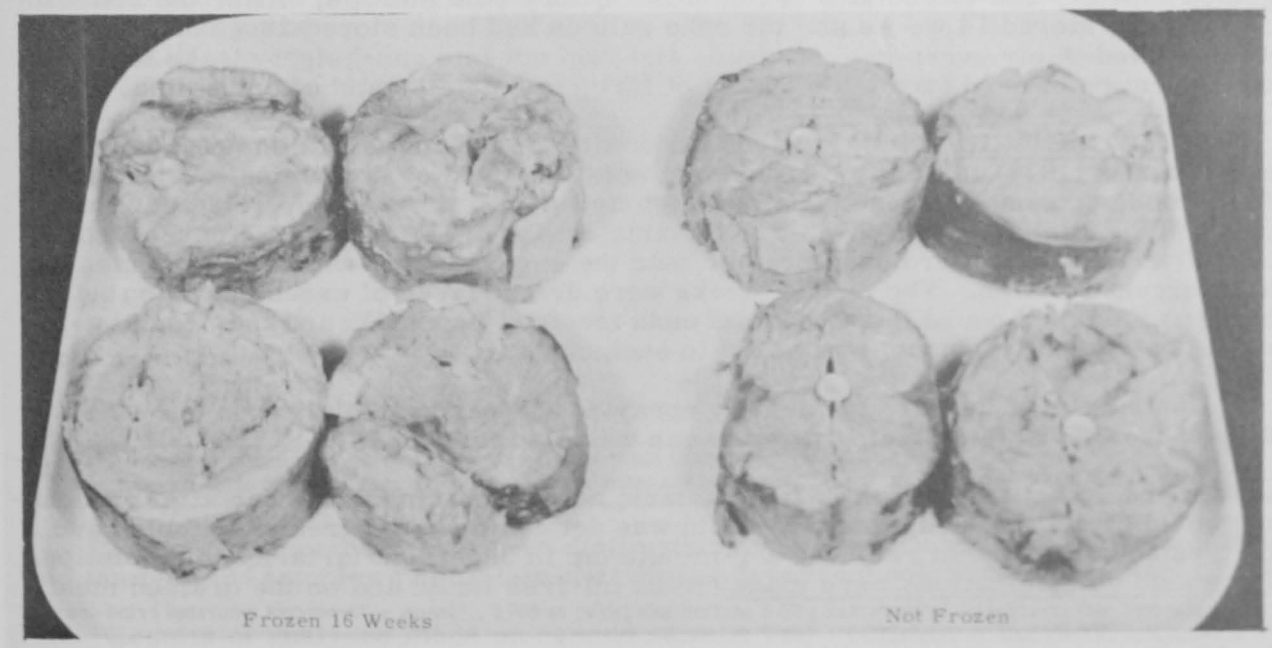

Fig. 1 - Canned red salmon--control and 16-week frozen product compared for curd in can.

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ed usually to Puget Sound ports, where they are thawed and canned. Stansby and Dassow (1951) found that freezing, storing, and later thawing and canning salmon resulted in a product of inferior quality as compared with canned salmon prepared from fresh fish. One of the objectionable differences was the frequent presence of large quantities of proteinaceous curd on the surface of the canned salmon (fig. 1). The curd deposit, being almost white in color, was most noticeable on the highly colored red salmon (Oncorhynchus nerka), which is the predominant species being frozen on the freezerships.

The formation of curd in canned salmon is not unique to the product prepared from frozen fish. Denstedt and Bailey (1934) discussed methods of preventing curd formation in canned fresh salmon. Tanikawa, Inoue, Akiba, and Numakura (1952) studied the formation of curd in canned frozen mackerel.

Denstedt and Bailey chemically coagulated the surface protein of the salmon by immersing the uncooked salmon for 10 minutes in 70-percent saturated sodium-chloride brine[1/] or in dilute acetic acid or citric acid solutions. They suggested that the coagulated surface protein formed a seal holding the dissolved protein within the meat until the heat of processing could coagulate it and make it immobile. Tarr (1942) showed that sodium chloride prevents drip in lightly-brined fish by causing the proteins to swell and to bind liquid firmly. Carter (1938) reported that dipping the raw meat of salmon in a weak solution of tartaric acid prior to canning gave the best protection against curd formation.

OBJECTIVE OF EXPERIMENTS

The objective of the present experiments was to determine the extent of curd reduction obtained by the use (1) of tartaric-acid dips and (2) of brine dips for pretreatment of thawed salmon steaks prior to canning.

EXPERIMENTAL

SAMPLES: Red salmon (Oncorhynchus nerka) and coho salmon (Oncorhynchus kisutch) were obtained from a local cannery approximately 18 hours after the fish were removed from a trap. The fish were frozen in the round at -20° F. in air, glazed heavily, and stored at 0° F. in a laboratory cold storage. After the red salmon had been stored 14 weeks and the coho salmon had been stored 28 weeks, the fish were thawed in air overnight, dressed, and then cut into can-height steaks for tests on prevention of curd formation by use of tartaric acid dips and of brine dips.

TARTARIC ACID DIPS: In accordance with the recommendations of Sunderland and Parsons (1937), a solution of tartaric acid was used as a chemical coagulant. Since modern cannery lines operate at high speed, dip times of $\frac{1}{4}$, $\frac{1}{2}$, 1, and 2 minutes in a 5-percent solution (w/w) of tartaric acid and 1 minute in a 2-percent solution of tartaric acid were used, rather than the suggested dip time of 10 minutes in a 3-percent solution. The dipped steaks were drained free of excess solution before being packed in $\frac{1}{2}$-pound flat C-enamel cans (seafood formula), and the normal amount of dry salt ($\frac{1}{8}$ ounce) was added to each can.

Application of the tartaric acid by spraying a 5-percent solution on the top surface of the steak after placing it in the can was also tried.

In order that the amount of free tartaric acid remaining in the can after processing could be ascertained, total free acid was determined on untreated samples and on treated samples that received a 1-minute dip in 5-percent tartaric-acid solution. Free acid determinations were made on the oil-free liquid and on the drained meat

1/ A saturated sodium-chloride brine contains 26.5 percent salt (w/w) at 60° F. Hence, a 70-percent saturated brine contains 18.5 percent salt by weight.

separately. Free tartaric acid was calculated from the difference in total acidity between the treated and untreated samples. The pH of the liquid was measured with a glass electrode.

BRINE DIPS: Dips of 10 minutes in a 70-percent saturated brine and of $\frac{1}{4}$, $\frac{1}{2}$, 1, and 2 minutes in a saturated brine were given thawed steaks in tests to reduce curd formation by brining. The steaks were then packed in $\frac{1}{2}$-pound flat C-enamel cans. Dry salt ($\frac{1}{8}$ ounce per $\frac{1}{2}$-pound can) was added only to those samples dipped 1 minute or less.

CONTROL SAMPLES: Control samples were packed in $\frac{1}{2}$-pound flat C-enamel cans. The normal amount of dry salt ($\frac{1}{8}$ ounce per $\frac{1}{2}$-pound can) was added to each can.

CANNING AND STORING: Cans were seamed at a vacuum of 18 to 20 inches, processed for 85 minutes at 242° F., and cooled in air. The samples were then stored at room temperature for 3 to 4 weeks before examination.

RESULTS

TARTARIC-ACID DIPS: After the thawed salmon steaks had been dipped for 1 minute in 5-percent tartaric acid solutions, the surface protein appeared to be completely coagulated--as if the steaks had been cooked.

The pretreatment of the salmon with tartaric-acid solutions prior to heat processing gave a marked reduction of curd in all tests. The 1- and 2-minute dips in 5-percent tartaric-acid solution were equally effective, and only very slight curd formation was evident. Dips of less than 1 minute in 5-percent tartaric-acid solution were progressively less effective. The 1-minute dip in 2-percent tartaric-acid solution was not nearly as effective as was the 1-minute dip in 5-percent tartaric-acid solution.

The normal bright red color of red salmon fades slightly during the canning process. The tartaric-acid treatment tended to prevent fading but altered the color slightly to an orange-red shade. This slight color change was not considered objectionable and would probably not have been noticed if untreated samples had not been used for comparison.

Table 1 - The pH and Free Tartaric Acid Content of Treated and Untreated Canned Salmon

Treatment of Salmon Prior to Canning	pH of Liquid 1/	Free Tartaric Acid in Liquid 1/	Free Tartaric Acid in Meat 1/	Free Tartaric Acid in Total Contents 2/
		(Percent)		
Steaks dipped 1 minute in 5-percent tartaric acid solution	6.0	0.07	0.02	0.03
Steaks left untreated	6.3	0	0	0

1/ Values were averages of results from six $\frac{1}{2}$-pound flat cans analyzed individually.
2/ Values were based on drained weight of 195 grams of meat and 35 grams of liquid and oil per $\frac{1}{2}$-pound flat can.

Taste-panel members could not distinguish any difference in flavor between untreated samples and samples given a 1-minute dip in a 5-percent solution of the tartaric acid.

Results of analyses made on canned salmon that received a 1-minute dip in a 5-percent solution of tartaric acid and on untreated canned salmon showed a total free

tartaric-acid content of 0.03 percent in the cans of the salmon receiving the dip. The presence of the tartaric acid lowered the pH from 6.3 to 6.0. Complete data are given in table 1.

An unexpected result of the dipping tests was that the tartaric-acid dip eliminated any sticking of the salmon to the cans.

Spraying the top surface of the steak with tartaric acid after the steak had been placed in the can gave some reduction in curd but was not as effective as was dipping. The spray method of applying the acid could probably be adapted for use with existing cannery lines and--with additional work--could likely be improved in effectiveness.

BRINE DIPS: Brining thawed steaks before placing them in the cans resulted in a significant reduction in curd formation. In the studies using saturated brine, the amount of curd reduction increased with the increasing duration of the dips. Of the brine treatments used, the 70-percent saturated brine and 10-minute dip gave the greatest reduction in curd.

COMPARISON OF DIPS: Although the 10-minute dip in 70-percent saturated brine produced a significant reduction in curd, it was less effective than was the 1-minute dip in 5-percent tartaric-acid solution. Shorter times with the saturated brine dips were much less efficient in reducing curd than were any of the tartaric acid dips.

Inspection of the canned salmon prepared from the frozen fish showed that samples treated with tartaric acid never adhered to any of the cans. On the other hand, both the untreated and brined samples showed excessive sticking of the meat to the can, resulting in pieces of meat being torn from the surface when the lid was removed. Brined samples were somewhat better in this respect than were the untreated lots but were definitely inferior to the tartaric acid-dipped salmon. Thus, the tartaric-acid treatment was not only the most effective for the reduction of curd formation in canned frozen salmon, but it also eliminated sticking of the meat to the can.

DISCUSSION

For commercial application, the 1-minute dip in 5-percent tartaric-acid solution appears to be the simplest and most effective treatment for the reduction of curd. The slight color change taking place in the acid-treated canned salmon should not be objectionable. To comply with U. S. Food and Drug regulations, however, a packer would have to state on the label that tartaric acid had been added. Enamelled cans should be used with the tartaric acid treatment to eliminate corrosion due to tartaric acid carried over to the inner surface of the can in high-speed processing.

The use of the 10-minute dip in 70-percent brine provides some correction of the excessive curd formation but would appear impractical commercially because of the long dipping time required.

Since a dipping procedure involves considerable modification of the cannery line, further study should be made--under commercial conditions--of the treatment of the salmon after filling the can.

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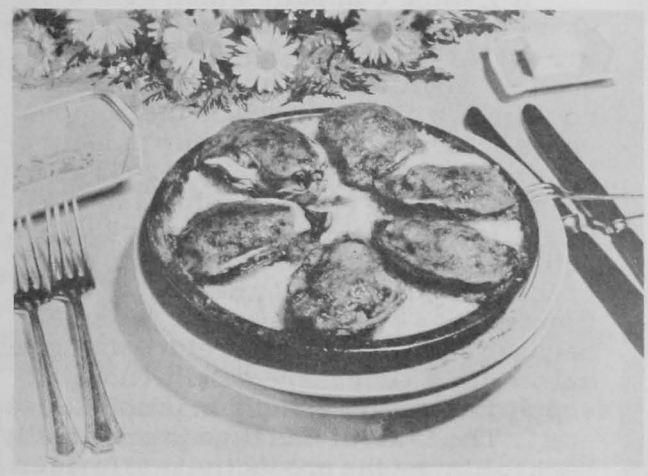
SEPTEMBER HERALDS NEW OYSTER SEASON

"Oysters R in season" has been added to "readin', writin', and 'rithmetic" to form the four R's of September, as the oyster season joins the "back to school" movement during the month of the equinox.

Oystermen can be seen these days in the bays and estuaries along the Pacific, Gulf, and Atlantic coasts--as far north as Cape Cod--busily dredging and tonging for these highly popular shellfish and preparing them for shipment to countless points throughout the Nation.



Oysters a la Rockefeller

According to reports received by the Department of the Interior's Fish and Wildlife Service, an average crop of oysters is expected this year. This means a fairly good supply throughout the season, which generally extends from September through April.

Raw oysters can be purchased in or out of the shell. Oyster meats are further processed and sold raw frozen, raw or cooked breaded, or canned. Regardless of the form, oysters have special appeal to the busy homemaker because they are easily prepared, entirely edible, and easy to serve. They can be served raw on the half-shell or in a cocktail, or cooked in a variety of ways such as baked, broiled, fried, or in combination dishes like stews, soups, chowders, and shore dinners. To retain the delicate distinctive flavor of oysters, never cook them too long--just enough to heat them thoroughly and still leave them plump and tender.

Either Eastern or Pacific oysters may be used in the following recipe for "Oysters Remick," developed and tested recently by the home economists of the U. S. Fish and Wildlife Service:

OYSTERS REMICK

36 shell oysters 1/
2 cups mayonnaise
1/4 cup chili sauce
1/8 teaspoon paprika
6 drops tabasco sauce
1 tablespoon prepared mustard
4 slices bacon
1/2 teaspoon salt
Dash pepper
2 teaspoons lemon juice
2 tablespoons butter or other fat, melted
1/2 cup dry bread crumbs

1/ If shell oysters are not available, 1 1/2 pints select oysters may be used. Drain oysters and arrange on a shallow, well-greased baking dish. Spread with seasonings and cook as above.

Shuck and drain oysters; place on deep half of shells. Combine mayonnaise and seasonings. Spread over oysters. Combine butter and crumbs and sprinkle over top of each oyster. Cut each slice of bacon into 9 pieces and place a piece on top of each oyster. Place on a preheated broiler pan about 3 inches from the source of heat. Broil for 5 minutes or until edges begin to curl. Serves 6.