RESEARCH DEVELOPING WAYS TO ASSURE BONELESS FISH PRODUCTS

Boneless fishery products will really be boneless if experiments being conducted by the U. S. Bureau of Commercial Fisheries at the East Boston Technological Laboratory are successful.

Up to the present time experiments made on fish sticks have proven the value of the fluoroscope in spot-checking this product for bone particles. Future experiments will include work on fish fillets and fish blocks and will also be directed at developing methods for continuous scrutiny of fish products on a commercial scale rather than on just a sample or spot-check basis. These projects will be followed by an economic study to relate fluoroscopy to the cost of production.

FIG. 1 - SETTING THE CONTROLS FOR THE X-RAY UNIT.

A truly bone-free fishery product would be much more attractive to the consumer and result in a greater utilization of fish, processors believe. At present a small percentage of bone-containing fillets get past even the most rigid inspection. It is hoped that the Bureau experiments will make it possible for the industry to detect every bone in the early stages of processing.

Research indicates that the fluoroscope will show up bones in fish blocks, fillets, or other products which are less than an inch in thickness.

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UTILIZING THE UNIQUE PROPERTIES OF FISH OILS

From time immemorial, men have braved the dangers of the deep to obtain their needed supplies of marine oils. Marine oils have traditionally been used to supply man with food, medicine, and a variety of industrial products. In many parts of the world, their importance for these uses is as great as ever; but in the United States the plentiful supply of fats and oils from other sources and the rapid development of synthetic products has diminished the need for fish oils to be used in the traditional ways.

Fish oils are known to be unique in containing a high percentage of long-chain fatty acids, with many double bonds. Most uses for which fish oils are employed, at present, do not make use of these unique properties. In many cases, they are an actual disadvantage.

The peculiar structure of fish-oil fatty acids make them potentially valuable for the manufacture of many industrial and pharmaceutical products. To develop these products, however, requires considerable research. In the meat industry, this type of research has led to the development of new byproducts which, in some instances, yield a profit far in excess of that from the sale of the meat itself.

Since 1953, the U. S. Fish and Wildlife Service has been investigating the chemistry of fish oils. From a small start at the Service's Seattle Fishery Technological Laboratory, the program has expanded to a nationwide program including contract research at various university and other laboratories. A number of different phases of the subject are being investigated.

The program includes a study of fish oil polyamino fatty acids, which should have excellent surface-active properties. These compounds have potential application as fungicides, corrosion inhibitors, detergents, and ore-flotation agents.

Another phase of the investigation is the preparation and separation of fatty alcohols made from fish oils. Why study fatty alcohols? They are extremely valuable in organic research because of the variety of other substances that can be prepared from them.

Derivatives of fish-oil fatty acids being prepared in the laboratory include alkyl halides, silicones, and quaternary ammonium salts. The alkyl halides are most important as intermediary compounds in the preparation of other potentially useful products. It is possible that a highly stable drying oil or a tough resilient copolymer may result from the production of silicones containing long-chain polyunsaturated alkyl groups. The quaternary ammonium salts have potential use in the production of disinfecting and preserving agents, detergents, fire-extinguishing foams, wetting agents, and flotation agents.

The future for fish oils thus is brightening. Research is taking advantage of their peculiarities in chemical structure and is making assets out of liabilities. By these studies, fish oils--in addition to their nutritional uses--may gain added prominence as a source material for many new industrial chemicals.

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KEEPING QUALITY AND RATE OF FREEZING OF COOKED LOBSTER MEAT

Preliminary tests on the storing of cooked meat from large deep-sea lobsters (Homarus americanus) in cans at 0° F. and at -20° F. show that lobster meat stored at -20° F. for 18 weeks was of good quality, while similar samples stored at 0° F. were of fair to barely acceptable quality. The effect of no vacuum, 14 inches of vacuum and 27 inches of vacuum on the storage life of the lobster meat at 0° and -20° F. was also studied; no significant difference in quality due to vacuum in the can could be detected.

The rate of freezing, in a blast freezer, of No. 2 cans containing one pound of lobster meat was also determined. It was found that with an air-stream velocity of 1,500 feet per minute and an air-stream temperature that decreased from -10° to

-35° F. during the freezing period, 85 minutes were required to cool the cans of lobster meat from 45° to 0° F., and an additional 15 minutes to cool the meat to -20° F. (North Atlantic Technological Laboratory, East Boston, Mass.)

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TECHNICAL NOTE NO. 41 - BACTERIAL STUDIES OF FROZEN RAW BREADED SHRIMP

ABSTRACT

THE TOTAL NUMBERS OF MICRO-ORGANISMS VARIED WIDELY IN THE FINISHED SHRIMP PRODUCTS EXAMINED AND IN THE COMPONENT RAW MATERIALS. ONLY ONE SAMPLE OF UNFROZEN RAW SHRIMP YIELDED A TOTAL COUNT OF LESS THAN 100,000 PER GRAM. THERE WERE NO SAMPLES OF FRESH OR FROZEN GREEN SHRIMP WITH COUNTS LESS THAN THIS NUMBER. BOTH BREADING AND BATTER MIXES CONTRIBUTED SIGNIFICANTLY TO THE TOTAL NUMBER OF MICRO-ORGANISMS. COAGULASE-POSITIVE STAPHYLOCOCCI WERE NOT DETECTABLE IN ANY OF THE SAMPLES PURCHASED IN FOOD STORES. IN ALL BUT ONE SAMPLE OF UNFROZEN GREEN RAW SHRIMP OBTAINED DIRECTLY FROM THE PROCESSOR, HOWEVER, COAGULASE-POSITIVE STAPHYLOCOCCI WERE PRESENT. STUDY OF THE RESULTS OF COLIFORM AND ENTEROCOCCI DETERMINATIONS REVEALED THE LATTER MAY BE THE MORE RELIABLE INDICATOR OF THE DEGREE OF SANITATION PRACTICED DURING PROCESSING. HIGH ENTEROCOCCI AND TOTAL COUNTS COUPLED WITH LOW COLIFORM COUNTS MAY INDICATE A LONG PERIOD OF FROZEN STORAGE OF THE BREADED SHRIMP PRIOR TO RETAIL SALE.

BACKGROUND

Sales of frozen raw and precooked fishery products have increased markedly in the last several years. Consumer acceptance of these products has made the development of voluntary grade standards desirable as an aid in the production and marketing of these products. The Fishery Technological Laboratory, U. S. Bureau of Commercial Fisheries, College Park, Md., is engaged in research designed to determine the various factors required for the development of such standards for a variety of frozen seafoods. The objective of one project is the investigation of microbiological procedures currently employed for the examination of foods in order to determine their suitability for use on frozen fishery products.

FIG. 1 - PREPARATION OF BREADED SHRIMP FOR USE IN BACTERIOLOGICAL STUDIES.

EXPERIMENTAL PROCEDURE

Samples of frozen raw breaded shrimp were obtained for bacteriological examination from retail sources in the College Park area as well as directly from several processors of breaded shrimp in the Brunswick, Ga., area. In addition, as soon as collected from the processors, samples of unfrozen raw shrimp, breading, and batter mixes were placed in sterile containers, frozen with dry ice, and transported to the laboratory for microbiological analysis. Wherever possible, catch data and storage histories were obtained for each sample.

For analysis, 20 grams of a sample were transferred acceptically to 180 milliliters of buffered dilution water contained in a sterilized Waring Blendor that had been chilled previously for 30 minutes in a refrigerator (American Public Health Association 1955). After the sample had been blended for 2 minutes and the resultant foam had been allowed to settle for 10 minutes, the following procedures were employed for the analyses:

PREPARATION OF DILUTIONS: From the initial 1-to-10 dilution of sample, dilutions of 1-to-1,000 and 1-to-100,000 were prepared as dilution blanks. From these, dilutions of from 1-to-10 to 1-to-100,000 were plated in triplicate in Nutrient Agar-1.5 percent NaCl (Baltimore Bilogical Laboratories). Incubation was carried out at 30° C. (86° F.), and plates containing between 30 and 300 colonies were counted after 72 hours, with the aid of a Quebec colony counter.

PREPARATION OF COLIFORM ANALYSES: Organisms of the coliform group were enumerated by use of the "Most Probable Number" (MPN) method employing five replicate tubes of Lactose Broth (Difco) in three dilutions (Hoskins 1940). The results of presumptive tests were confirmed in Brilliant Green Bile Broth (Difco). Temperature in time of incubation for both procedures was 37° C. (91° F.) for 48 hours.

PREPARATION OF ENTEROCOCCI ANALYSES: The importance of enterococci (fecal streptococci) as a more certain indicator of pollution of fish and shellfish has been demonstrated by Winter and Sandholzer (1946) and by Fellers, Gagnon, and Kiyoshi (1956). A modification of the standard MPN procedure as described by the latter authors was employed for the enumeration of this group of organisms. Three dilutions of sample were innoculated into five replicates of double-strength Azide

Table 1 - Microbial Populations of Authentic Samples of Green and of Processed Shrimp from Commercial Plants

Sample Number	Plant Number	Plant Operation	Total Count Per Gram (Thousands)	Coliforms Per Gram	Enterococci Per Gram	Coagulase-Positive Staphylococci 1/
1	A	Fresh unheaded green shrimp, packed in ice (landed 2 hours previously).	160	350	240	± 2/
2	B	48 hours in cooler, shrimp, headed, deiced, machine-graded, manually peeled and deveined 36-40 count.	1,700	38	130	++++
3	B	48 hours or longer in cooler, shrimp, manually peeled and deveined 36-40 count.	130	22	26	±
4	B	48 hours or longer in cooler, shrimp, peeled and deveined, manual pinning operation.	980	210	>2,400	++
5	B	Batter, used all day and reinforced with fresh mixture as used.	280	1,600	540	-
6	B	Breading, used all day, sifted periodically and reinforced as used.	78	350	140	-
7	B	48 hours or longer in cooler, shrimp, peeled and deveined, stored in cooler for pinning operation.	390	3.6	170	±
8	B	Peeled and deveined, shrimp, in cooler awaiting pinning, not more than 16 hours in cooler.	480	0	1,600	+++
9	B	10-oz. pack of breaded shrimp, hand boxed, after 30-45 minutes of blast breezing.	230	49	540	+
10	B	Green shrimp, graded, peeled, deveined, 13 hours since landing.	660	4	17	±
11	B	Breading, used in #10, taken 45 minutes after preparation.	75	7.8	920	±
12	B	Batter, used in #10 taken 60 minutes after preparation.	1,900	33	>2,400	++
13	B	10-oz. pack of breaded shrimp, hand boxed, after 30-45 minutes of blast freezing, green shrimp from sample #10.	1,200	26	280	+
14	C	Green shrimp, storage history unknown, composite of several boxes of iced shrimp.	82	17	79	-
15	C	Batter, cooled storage tank, age unknown.	150	170	920	-
16	C	Breading, sample of sifted breading in use during day operation.	41	350	1,600	-
17						
18	C	10-oz. pack, breaded shrimp, hand boxed, taken from day's production using #14, 15, 16.	490	70	>2,400	±
19	D	Green shrimp, composite of unknown history.	960	20	540	++
20	D	Batter mix, unknown history.	200	11	49	-
21	D	Breading mix, unknown history.	150	0	49	-
22	D	10 oz. pack of breaded shrimp, from day's production	1,900	7.8	>2,400	++++

1/ THE TERM "STAPHYLOCOCCI" IS USED CONVENTIONALLY IN PLACE OF THE ACCEPTED NOMENCLATURE, MICROCOCCUS PYOGENES OFTEN USED AS AN INDEX OF THE QUALITY OF A PRODUCT.
2/ QUALITATIVE SYMBOLS: ++++ HEAVY GROWTH \ +++ MODERATE \ ++ LIGHT \ + FEW COLONIES \ ± ONE COLONY, NONCOAGULASE PRODUCING \ - NEGATIVE

Dextrose Broth (BBL) and incubated at 37° C. If turbidity was observed at the end of 48 hours, a large loopful was innoculated into Ethyl Violet-Azide Broth (BBL), and the tube was incubated for 48 hours at 37° C. (91° F.). The formation of a "purple button" of sodiment at the bottom of the tube was interpreted as a positive confirmed test. Microscopic examination of stained preparations of these sediments revealed gram positive cocci in chains.

PREPARATION OF STAPHYLOCOCCI ANALYSES: Qualitative detection of coagulase-positive staphylococci was carried out by streaking 0.02 milliliters of the 1-to-10 dilution on duplicate plates of Tellurite Glycine Agar (BBL) and incubating the plates at 37° C. (91° F.) for 48 to 72 hours. Zebovitz, Evans, and Niven (1955) have demonstrated that the appearance of jet black colonies is to be interpreted as a positive presumptive test. Standard coagulase tests were carried out with incubation for 1 hour at a 37° C. (91° F.) water bath, on isolates that had been propagated in Brain Heart Infusion Broth (Difco) for 16 to 18 hours at 37° C. (91° F.).

RESULTS AND DISCUSSION

Table 1 indicates that a wide range existed in total numbers of micro-organisms in the finished product and in the raw component materials. Only sample number 14 of unfrozen raw shrimp yielded a total count of less than 100,000 per gram. There were no samples of frozen raw green shrimp with counts under this number. Both breading and batter mixes contributed significantly to the total numbers of micro-organisms.

Table 2 - Analyses of Samples Obtained from Retail Sources

Sample No.	Brand	Total Count Per Gram (Thousands)	Coliforms Per Gram	Enterococci Per Gram	Coagulase-Positive Staphylococci1/
1	A	920	11	280	-
2	A	3,400	920	1,600	-
3	A	84	140	1,600	-
4	B	210	13	>2,400	-
5	B	1,000	33	>2,400	-
6	B	620	140	920	-
7	C	88	7	240	-
8	C	150	350	540	-
9	D	150	17	920	-
10	D	650	33	46	-
11	E	130	1,600	2,400	-
12	E	300	280	1,600	-
13	F	660	110	>2,400	-
14	G	700	49	79	-
15	G	30	33	>2,400	-
16	H	400	33	>2,400	-
17	J	410	79	920	-
18	K	120	220	920	-

1/THE TERM "STAPHYLOCOCCI" IS USED CONVENTIONALLY IN PLACE OF THE ACCEPTED NOMENCLATURE, MICROCOCCUS PYOGENES.

Coagulase-positive staphylococci were not detectable in any of the samples purchased in local food stores (table 2). It was impossible to determine the age of these samples, since storage histories and catch data were not available. One may only infer that this organism does not remain viable in samples subjected to prolonged frozen storage and that no information would be forthcoming from procedures designed for their detection in these samples.

In all but one sample of unfrozen raw green shrimp and in all samples of the finished frozen breaded product, received directly from the processors, coagulase-

positive staphylococci were present (table 1). It became evident that the inclusion of of coagulase-positive staphylococci in any microbiological standard for frozen raw breaded shrimp would be dependent upon whether processing plant or retail samples were examined.

Further study of the results of coliform and enterococci determinations revealed that the latter may be a more reliable indicator of the degree of sanitation practical during processing of the product. The magnitude of the total counts paralleled more closely the occurrence of greater numbers of enterococci in all of the products examined than the coliform counts. Previous work reported by Fellers et al (1956) has demonstrated that enterococci are more resistant to frozen-storage temperatures than are coliform organisms, since survival curves of the latter show a steady decrease in numbers of viable organisms with time in storage. It is possible that high enterococci and total counts coupled with low coliform counts indicate extended frozen storage of the frozen breaded shrimp prior to actual sale to the consumer.

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STUDIES ON THE FREE LIQUOR, SALT, AND DRY SOLIDS RELATIONSHIPS OF OYSTERS CONTINUED

With start of the oyster season in the Tidewater area of Virginia during the last week of August 1957, the College Park Fishery Technological Laboratory of the U. S. Fish and Wildlife Service has resumed the study, begun in the spring of 1957, of the interrelationship of dry solids, free liquor and salt, and the effect of variations in processing and storage conditions on these factors for oysters. Production during September has been good with ample quantities of shell oysters and fairly high yield of the shucked product for this early in the season. The study was originated to provide the industry with information needed to further improve the methods in processing oysters.

NOTE: SEE COMMERCIAL FISHERIES REVIEW, JUNE 1957, P. 15.

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