FIRST ALASKA SURIMI, INC.

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SURIMI AS AN INGREDIENT IN A NEW SALMON JERKY PRODUCT

INTRODUCTION

Alaska Fisheries Development Foundation's desire to explore potential new market opportunities for pollock surimi led to this project. The intent of the work was to examine the viability of surimi as an ingredient in a smoked salmon jerky.

This report is not intended as a guide to the production of salmon/surimi jerky, and will not reveal proprietary information on product formulations. Rather it describes the product development process, discusses the technical problems confronted and suggests approaches to solving those problems. The central aim of this report is to share technical information about the performance of surimi in a processed "meat" product, with the hope that it will stimulate the product development process elsewhere.

BACKGROUND

Smoked salmon jerky products made from minced salmon, recently introduced to the snack food market, are enjoying strong consumer acceptance. A few west coast seafood processors have begun producing salmon jerky, and the prevailing impression is that the market, especially relative to production capacity, is "insatiable." This fortunate condition has its dark side, however, since large-scale production systems are expensive investments, and at this point producers are still struggling with some basic technical difficulties.

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Faced with large market commitments and a limited production capacity, Seafoods From Alaska, a salmon processor in Sterling, Alaska, hit upon the idea of using surimi as an ingredient in their jerky strip. Owners Roland Schwanke and Gary Ervin reasoned that if low grade surimi could be incorporated at a significant level, it might help them increase production volumes, cut costs and improve quality control. However, Seafoods From Alaska was not in a position to pursue this idea on their own. They had no experience with surimi, and they needed more hours in a day just to produce enough salmon jerky to fill all their orders.

Schwanke and Ervin had been working on some of their other technical and product development challenges with First Alaska Surimi, Inc., an Anchorage-based research and development services company. Richard Rhoda, the firm's owner, saw how the product represented an important opportunity for Alaska Fisheries Development Foundation (AFDF, a private non-profit trade association in Anchorage.) Two years earlier, AFDF had begun a program to stimulate development of a U.S. surimi industry. Under the stewardship of AFDF, commercial production of surimi in Alaska had begun in January 1985 as the cornerstone of the new industry. AFDF was anxious to encourage new product applications that would demonstrate surimi's unique functional value and versatility.

The immense popularity of imitation crab products (made from surimi) among American consumers was translating into marketing constraints for prospective producers of surimi in Alaska. Almost all of the imitation crab products were being made in Japan, and only the highest grades of surimi were used. To give American surimi producers more marketing flexibility, and to bring more of the profits from surimi-based products to American businesses, the Foundation wanted to create more diversity in the U.S. market for surimi.

Though many American food companies had obtained samples of surimi and technical literature from AFDF, none had yet reached the commercialization stage with a new product. If it could be shown that a jerky product would incorporate surimi and provide economic and technical advantages, the Foundation would have access to a valuable market development tool.

Not incidentally, AFDF saw revenue potential in the jerky product. The Foundation would, by early 1986, have more than half a million pounds of Alaska-produced surimi available for sale, by virtue of their production contract with Alaska Pacific Seafoods in Kodiak, Alaska. A portion of the pack would be of lower grade (i.e. lower gel strength, darker color, lesser water-binding capability) than the high-gel surimi required to produce imitation crab. A demonstration of the effective use of low grade surimi in a commercial product would be a definite aid to the sales effort. It might even help create jobs and business revenue within the state, and an in-state market for surimi that would cut transportation costs for producers. It would also be an encouraging sign for prospective Alaskan surimi producers, who were justifiably worried about finding markets for low grade surimi.

Thus the complementary interests of AFDF and Seafoods From Alaska were merged in this product development project. The primary objective was to assess the technical feasibility of incorporating pollock surimi as an ingredient in a new salmon jerky product. Five days of experimentation and product testing were to be devoted to this objective, with Seafoods From Alaska providing the laboratory and processing facilities, materials and personnel. First Alaska Surimi was to provide supervision and technical assistance, as well as a report on the project's findings. The Foundation agreed to contribute $4900 toward the costs of the project, which was used by First Alaska Surimi to procure the services of Dr. Neil Webb, president of Webb Foodlab, Inc. of Raleigh, North Carolina. Dr. Webb had worked with private companies on a variety of jerky products, and had just completed a study for AFDF on the functional properties of surimi in processed meat systems.

EXPERIMENTAL APPROACH

Nine test batches of jerky were prepared at Seafoods From Alaska during the week of July 29, 1985. The first eight batches were 25 pounds each, and contained varying amounts of surimi, from zero to 42% by weight. The ninth batch duplicated the formulation perceived as most desirable of the eight, in a quantity of 150 pounds. The ninth "confirming" batch was large enough to be prepared in the commercial size mixer and grinder and extruded through a multiple-port nozzle, while the 25 pound batches required hand-mixing and extrusion through a single nozzle.

In addition to varying the amount of surimi used, the test batches also varied the species of salmon, the grade of surimi used, the presence or absence of oil and water in the formulation, and the time and temperature regime used in the smokehouse. To monitor moisture content of ingredients and product at intervals throughout the process, a microwave moisture analyzer made by CEM Corporation of Indian Trail, NC was employed.

The basic process flow used in this flow used in this project was to mince fresh (split) salmon using a belt-and-drum deboner, and mix it with the other ingredients (salt, sugar, pepper, water), add tempered surimi and run the mixture through a grinder to prepare a homogeneous batter. The mixture was then placed in a piston stuffer and forced through an extrusion nozzle in strips, onto a teflon screen which was laid over the stainless steel smokehouse racks. The entire cooking, curing and drying cycle was completed in the smokehouse, including a short pasteurization period. The strips were then cut into ½-ounce portions and individually vacuum packaged.

INTERPRETATION OF RESULTS

Seafoods From Alaska had earlier identified two "problem areas" with the salmon jerky product: (1) Salt crystallization on the product's surface during storage after vacuum packaging, and (2) Negative consumer reaction to toughness and saltiness.

There was no expectation that using surimi would solve these problems. In fact, addition of any new ingredient could only make the obstacles more complex. Furthermore, the surimi might bring its own potential problems, such as excessive sweetness.

In developing a salmon jerky that incorporates surimi, a number of variables in the formulation and process were considered. Following is a discussion of each variable, with comments on how it may influence the characteristics of the product, based on experience with the test batches.

(1) MOISTURE CONTENT

The ability to control final moisture content of the jerky within a fairly narrow range appears to be a primary key to solving the technical problems experienced with the product, particularly when surimi is an ingredient. If moisture content is too low, salt crystallization will occur and the product's texture will be tough and crumbly. If moisture content is too high, there is risk of bacterial spoilage and some consumers may feel the texture is too soft and pliable. Moisture content will also affect the flavor balance of the jerky. On the basis of a yield analysis done on the final batch of jerky, it seems possible to control moisture contents (and thus yields) of fisnished product within an acceptable range without adjustments in the process regime.

The target moisture content for finished jerky chosen after these experiments was about 30% when pulled from the smokehouse. By the time the product is packed, its moisture content will have dropped about one percentage point. At this level, yields can be expected to be close to 40%.

Depending upon air flow conditions in the smokehouse, there will be variation in moisture content of samples taken at the same time from different locations in the cage. One sampling of yield values (N=5) done during this project indicated a standard deviation of 1.3 percentage points around a mean of 39.5%, associated with moisture contents ranging from 27.2% to 31.0% (mean 29.0%, standard deviation 1.6).

The use of a rapid accurate moisture analysis method is necessary in order to produce a product with consistent moisture content. Control of moisture content is perhaps even more important to production economics than it is to consumer acceptance and product quality. If the operator must guess on the safe side to keep water-phase salt in all product above 16%, as required by State regulations, then he will be sacrificing yield and thus revenue. From experience during this project, we would estimate the yield loss at about 6 pounds per hundred weight of finished product.

(2) AMOUNT OF SURIMI

The proportion of the formulation that was surimi did not have predictable effects on product quality. The nine test batches ranged from 0 to 42% of total weight in surimi content. There are slight indications that the higher levels of surimi may contribute to a more noticeable "skin" on the product and a more "mealy" texture, but further experimentation is needed to explore this possibility. It is likely that these effects would be related more to the quality of surimi used than to the quantity. Among the first eight test batches of project, it was a formula containing 36% surimi that was deemed the "best" product. There were no obvious and consistent differences in palatability between the product containing no surimi and that containing 36% surimi. A valid comparison could not be made with batches containing even higher levels, because of differences in amounts of other constituents.

(3) TYPE OF SURIMI

In this type of product, high quality surimi is probably a liability. Its high gel strength may impart undesirable texture, and because it binds water strongly, it may take longer to dry to the desired moisture level.

However, the data generated during this project are not extensive enough to lend statistically valid support to that theory.

For the test batches of this project, the quality of the surimi used ranged from very low to above average. The surimi of very poor gel strength did appear to cause problems during extrusion, with the strips breaking easily as they were laid down. The higher gel strength of the moderately high quality surimi did not contribute any obvious benefits to the product, either in ease of processing or finished quality.

The most important characteristic of surimi for use in this jerky product is that it should be free of any "fishy" odor or flavor.

(4) OTHER INGREDIENTS: OIL AND WATER

Since the fat content of surimi is very low, vegetable oil was added to most of the test batches in order to bring the fat level of the mixture up to that of the standard salmon recipe. With the higher oil content, the batter mixes and extrudes more evenly. Also the oil seems to contribute positively to flavor. If oil content is too high, however, it will rise to the surface of the product during cooking or after packaging.

Adding a small amount of water to the batter after the dry ingredients seems to aid in the solubilization of the salmon proteins. The one test batch prepared without added water was relatively difficult to mix and extrude, being described as "very sticky but also dry."

(5) ORDER OF INGREDIENT ADDITION

This is a matter of choosing what works best for a given processing system. It is important to provide adequate mixing time, particularly for the salmon, without reducing particle size or elevating the batter temperature too much. For all of these test batches, surimi and oil were added last, to avoid premature heat-setting of the surimi and ensure homogeneous distribution of dry ingredients.

(6) TEMPERING OF FROZEN INGREDIENTS

Overnight tempering in a cold room for both the fresh salmon mince and the frozen surimi seems to make these ingredients easier to mix. It is not advisable to thaw the surimi beyond the point where it can be handled by the mixer.

(7) SMOKEHOUSE REGIME

The parameters to be considered here are time, temperature, and relative humidity. This project did not systematically analyze alternative regimes, but it is important that the producer examine options that might improve product quality or reduce cycle time. One significant observation that can

be contributed here is that setting a higher relative humidity during cooking appears to prevent formation of a thick "skin" on the jerky strips and allow more rapid curing. Also, from the limited data collected on moisture contents during the cure, it appears that the presence of surimi in the formula allows reduction of curing time.

CONCLUSIONS: SUITABILITY OF SURIMI AS AN INGREDIENT IN SALMON JERKY

The primary argument for incorporating into salmon jerky is the reduction of ingredient costs. Using surimi also reduces processing costs, since it does not have to be minced before use as the salmon does. Surimi can comprise more than 35% of the jerky "batter" without negative impact on flavor or texture of the finished product. In fact, its unique functional abilities may actually improve product quality and ease of processing. Because of its water-binding capability, it may also help protect against bacterial spoilage and extend the product's shelf life.

Surimi of very poor quality can be used effectively in salmon jerky, as long as it imports no flavor or odor to the product. The fundamental key to product quality is the optimization and consistent control of moisture content.

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MOISTURE DATA

T_0 = Time when product went into smokehouse.

BATCH	HRS. AFTER T_0	% MOISTURE	FORMULATION Surimi	Added oil	Added H_2O
A	1.5	50.70	none	no	yes
	3.5	46.23			
	4.0	42.03			
	5.2	37.71			
	5.7	35.82			
	6.2	35.94			
	6.7	34.12			
	7.2	33.52			
	7.5	31.78			
B	1.5	52.12	42%	no	yes
	3.5	44.93			
	4.0	34.57			
	4.0	33.20			
	4.7	32.58			
C	1.5	50.84	42%	yes	no
	3.5	43.81			
	4.0	38.88			
	4.7	37.21			
	5.7	30.58			
D	1.5	51.32	25%	yes	yes
	3.5	42.46			
	4.0	35.46			
	4.7	34.26			
	5.2	32.57			
CONTROL	1.5	54.78	none	yes	yes
	2.2	43.60			
	2.6	46.50			
	2.6	48.32			
	3.9	38.57			
	5.1	36.56			
	6.0	33.00			
	6.0 +	31.39	(out of smokehouse 1.2 hr. @ room temperature)		

These data were compiled at Seafoods From Alaska, Sterling, Alaska, August 1985.

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YIELD ANALYSIS

RACK	BATTER INITIAL WT., LBS.	FINAL WT.	% YIELD
A	7.81	3.19	40.8
B	7.81	3.06	39.2
C	7.63	2.88	37.8
D	7.94	3.25	40.9
E	8.00	3.12	39.0

AVERAGE YIELD = 39.5%

s = 1.3% (std. dev.)

SAMPLE RANGE = 37.8 to 40.9%

These data were compiled at Seafoods From Alaska, Sterling, Alaska, August 1985.

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NEIL B. WEBB

REPORT OF SURIMI APPLICATIONS FOR SALMON JERKY

SEAFOODS FROM ALASKA, July 29 - August 2, 1985

Seafoods from Alaska has developed and is currently marketing a smoked salmon jerky. Initial market penetration has indicated that the product has good consumer acceptance, but during storage excessive salt crystallization develops on the surface. This condition has resulted in the temporary withdrawal of the product from the market.

The objectives of this project were to test the utilization of Alaska pollock surimi in the salmon jerky formulation to improve the jerky matrix and thus eliminate the salt crystallization, while also reducing the cost of raw materials.

Preliminary testing with the replacement of part of the salmon with surimi indicated that excessive toughness and rubberiness was produced in the jerky. Also, it was determined that extremely high variations in the moisture content of the finished jerky were occurring due to the methods of processing.

The plant work involved the testing of various types and levels of surimi as a replacement for part of the salmon, modifications of processing methods, and the application of a rapid moisture analysis system (CEM moisture tester) for control of moisture in the finished jerky.

After preparing nine test batches, an acceptable product was developed, pending additional shelf-life testing. The new product was developed by: (1) Utilizing low grade surimi, which had high quality freshness ratings, at approximately 35% of the formula; (2) Addition of oil to replace the oil removed with the salmon/surimi replacement: (3) Modification of the mixing/grinding procedures; (4) Modification of the smoking/cooking/drying process; (5) Improved control of the moisture content during processing.

The benefits of this project are projected to be: (1) Reduction in formulation costs of approximately $25,000 for the first year and increasing thereafter, depending on volume of sales, by utilizing surimi in conjunction with oil addition (surimi and oil replacement at approximately 38% of the formula).

(2) Increased product yield due to improved quality control of the finished product composition; estimated at $58,000 for the first year and increasing thereafter.

(3) Improved product quality by the development of an acceptable texture with a significant level of surimi in the product formulation. It is postulated that the salt crystallization problem has been eliminated, but this will need to be confirmed by shelf-life testing.

(4) Assistance in the development of process design and control to plan for substantial increases in production volumes during the next year. This will result in a substantial reduction in the cost of production.

If this work is to provide continued growth in surimi sales, there will need to be follow-up assistance to Seafoods from Alaska to further refine the process for the successful utilization of surimi in the jerky, as well as additional products.