

PRODUCT DEVELOPMENT: SURIMI AND MEAT

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**SURIMI DESCRIPTION AND TECHNICAL DATA**

**SURIMI/MEAT PRODUCT DEVELOPMENT:**

**GENERAL GUIDELINES AND INFORMATION**

## Surimi Description and General Attributes

Surimi is a refined form of minced fish meat; an intermediate raw myofibrillar protein which is highly functional, low in calories and cholesterol. Two major distinguishing features of this raw material protein are its gel-forming capacity, which allows it to assume almost any texture desired, and its long-term stability in frozen storage.

Surimi's unique gelling ability is partially related to its ability to gel at lower temperatures than other proteins. Thermal characteristics of pollock actomyosin endow surimi with the capability of setting into strong network structures at the relatively low processing temperatures required in some processed meat products, such as a refrigerated or frozen restructured products.

When surimi is blended with red meat protein the resulting gel strength of the blend is higher than either of the two proteins when separate. In some cases, this synergistic effect has improved the red meat binding potential by as much as 318%.

Surimi provides potential cost benefits through:

1. Increased production yields due to high water and fat binding capabilities
2. Decreased product waste through consistency in functional performance
3. Decreased product waste through greater tolerance in processing to margins of error in certain formulations
4. Fuller utilization of low bind meats

The use of surimi enables fuller utilization of lower bind (less expensive) cuts of meat such as beef 50s and 50 - 60 pork trim due to the synergistic effect between surimi and these meat proteins.

In addition to cost cutting attributes, the nutritional benefits of surimi can create an increased value perception at the consumer level to offer higher retail pricing opportunities.

Odorless, colorless, and neutral tasting, surimi can be blended with a wide range of meat product ingredients to enhance existing items, extend product lines, or create entirely new food items. Surimi can carry flavor, control texture and assume desired end product appearance as user needs dictate.

Surimi offers today's health conscious consumer a premium source of protein. Biochemical research on Alaska pollock surimi reveals that as a natural protein, it has an amino acid composition which is similar, and in some cases, superior to that of high quality proteins. In addition, prepared meat products using surimi as an ingredient can claim lower fat content and decreased cholesterol.

## Surimi Technical Data

### Typical Data:

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Color/form	white - grayish frozen block
Moisture	72% - 83%
pH	6.8 - 7.2
Gelatinization Temperature	40 C/90 C
Protein Content	16% - 19%
Fat Content	0.5%
Ash Content	0.5%
Sucrose	4%
Sorbitol	4%
Phosphates	0.3%

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## General Guidelines

- I. Purchasing Surimi - for beef and pork product formulas with 50% or greater fat content.

Use surimi in range of 100 to 800 gel strength (jelly strength). Use of high gel strength surimi in most meat products (except as a bind compensator for marginally fresh/temperature abused meats) will create an extremely firm gel set, rendering an unacceptable "rubbery" mouth-feel in the final product.

(Test parameters)

- A. As measured by Punch Test
- B. Test performed without starch
- C. 3% added salt to product gel
- D. Final moisture in surimi not relevant here
  1. As indicated by range of gel strengths
  2. Moistures for the range of gel strength 100 - 800 can be 72% to 83%
- E. Without vacuum chopping

## II. Handling Raw Material Surimi

- A. Keep surimi frozen at -20 C or cooler. Do not store at -10 C; this is the optimum temperature for fish myosin frozen denaturation.
- B. Fluctuating temperatures will also reduce gelling ability
- C. Treatment and/or handling of frozen surimi blocks should be similar to Mechanically deboned chicken meat or mechanically deboned turkey meat.

## III. Formulating

- A. In combination with non-meat proteins

1. General benefits

Surimi can be used in combination with non-meat proteins (i.e. soy isolates, concentrates, TVPs, etc. and milk protein hydrolysates and caseinates, etc.) to enhance specifically desired product attributes such as:

- \* decreased drip losses (syneresis)

(Formulating with non-meat proteins cont...)

- \* decreased purge
- \* increased yields
- \* increased juiciness through water retention
- \* prevention of water migration during heating (primary - processor or secondary - end consumer)

2. Formulating with non-meat proteins and additives:

- a. Addition levels of 1% to 3%
- b. Up to a total formula level of 0.3% phosphates
- c. Do not blend non-muscle proteins with surimi to form a pre-emulsion, rather (if desired) form pre-emulsion with fat portion or with the fatty meats.
- d. During final chopping or mixing stages, add the surimi with the lean meat portion.
- e. Treat surimi as any highly functional lean red meat or poultry
- f. Some non-muscle additives known to have good water-binding properties in foods can effect extensive loss of the gel matrix structure formed by a surimi/meat mixture:
  - i. Do not formulate with carbohydrate gums, in particular Xanthan gum. This results in mushy texture from the gum's disruption of gel matrix network.
  - ii. Do not use pre-gelatinized starch with surimi. A mushy, watery product will result.

(Pre-gelatinized starch does not have any granule structure to support water holding properties; acts as interference to matrix structure)

**B. Formula inclusion levels of surimi**

Surimi functional usage levels in blended application perform well anywhere between the 3% and 50% range. Inclusion levels within this range depend on manufacturer product concepts, requirements, and costing goals.

**C. Provide for Surimi Cryoprotectants in Formulating**

During formulation, existing levels of phosphate, sugar, and sorbitol must be taken into account for calculation of these as added ingredients.



- D. Up to 30% water added to the formula may be utilized in the meat block (depending on type of product and USDA regulations)
- E. Fat smearing - inclusion of surimi in formula will not result in fat smearing as with other muscle proteins
- F. Formula stability - will not experience formula instability problems as with MDMP addition; processors should experience an increase in formula processing stability.

#### IV. Processing

- A. No specialized equipment is necessary to handle, manufacture, or process surimi/meat blends. Normal manufacturing procedures can be used. With surimi, it is not necessary to adjust or modify current manufacturing procedures.
- B. Do not pre-blend, pre-cure, or form pre-emulsion
- C. Temper thaw and mix surimi in with meat during
  - 1. Grinding
  - 2. Bowl Chopping
  - 3. Mixer
- D. Flake if used frozen, and add to mixer or bowl chopper
- E. During chopping, care should be taken to prevent temperature increases in the meat batter. Surimi proteins are more sensitive to heat coagulation, and subsequent denaturation, than are red meats. This is by virtue of the fact that surimi proteins will form a stable gel at room temperatures, and at fairly low processing temperatures. Extra care must therefore be taken during processing to closely monitor any temperature rises in chopping, mixing, or blending stages.
  - 1. Aim for less temperature rise during processing; maintain at 6 C or less.
  - 2. If possible, utilize water-jacketed mixers and choppers to keep temperatures down.
  - 3. Use mixture of ice and water or straight ice as the water addition portion of formula
- F. In combination with chicken meats and skin - use dry ice during mixing to facilitate adequate dispersion of surimi in blend

#### IV. Storage of End Products (General)

Surimi is freezer stable. It enables prolonged frozen shelf life for raw materials as well as for end products. Chicken and pork nuggets formulated with 15% surimi have maintained a high degree of "perceived" freshness after 2.5 years of frozen storage.

#### V. General Information Regarding Surimi/Meat Admixtures

##### A. Color

1. Surimi will take on the color of whatever meat is used in system; it promotes good cured color in cured meat systems.
2. Surimi, alone, will not produce good cured color. Color formation would be similar to that of cured chicken or turkey breast (very pale pink), but without the cured ring formation which is apparent on the exterior of edges of cooked breast rolls.
3. Surimi will not act to dilute (make whiter) the color of red meat products as do white poultry meats and mild proteins.

##### B. Applications - product forms

Surimi/meat products can be restructured, raw frozen, partially cooked or fully cooked. POCs should be designed accordingly.

##### C. Texture Control - in Mechanically deboned poultry meat products

Surimi can control texture in MDMP products. A typical problem in chicken franks is a mushy texture coupled with gritty mouth-feel from pulverized bone content; over correction yields a rubbery product. Relatively low inclusion levels of surimi rectifies texture problems in these types of products.

##### D. Liquid cookout - The use of surimi in blended meat systems improves fat binding abilities and reduces liquid cookout over all in red meat systems. (see chart page 75)

##### E. Synergism between meat and surimi - Synergistic effect in surimi/meat systems improves binding potential of red meats even at temperatures known to produce the classic "midori" effect (weakened gel strengths) in surimi.

## Fat and Liquid Cookout

### TOTAL FAT AND LIQUID COOKOUT VALUES FOR EMULSIONS PREPARED WITH SURIMI UNDER VARYING PROCESS CONDITIONS

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Emulsion Treatment	Cook Temp. 0 C	Total Cook	Fat Cookout ml/100g	Liquid Content ml/100g
-----				
15% - 460 gel strength	70	15.5	1.0	14.0
Alaska Pollock Surimi	90	14.7	0.8	12.8
-----				
15% - 250 gel strength	70	8.2	0.4	6.8
Alaska Pollock Surimi	90	7.0	0.3	5.8
-----				
Control, no surimi	70	22.4	3.7	17.4
	90	23.5	4.7	17.2

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\* Webb Foodlab, Inc. Functional Properties of Alaska Pollock Surimi  
for Application in the Food Industry 1985 pg. 7

## Generic Nugget Formulas

Batter and breaded, deep fat fried nugget products were used as the system representation of non-standardized meat products as part of the USDA label approval efforts for surimi use in meat products.

Nugget-type products were selected since they could depict surimi functionality in either a relatively finely comminuted product, or in a more coarse ground, chunked/formed product.

### PORK/SURIMI NUGGETS

<u>Ingredient</u>	<u>%</u>
Regular Pork Trimmings (50% lean).....	48.66
Alaska Pollock Surimi.....	15.04
(Alaska pollock.....)	13.87)
(sucrose.....)	0.60)
(sorbitol.....)	0.53)
(sodium phosphate.....)	0.04)
Iced Water.....	7.30
Spice.....	1.28
Natural Pork Flavoring (#111376)*.....	0.30
Curing Salts.....	0.15
(salt.....)	0.1458)
(sodium nitrite @ 6.25%....)	0.0096)
Sodium phosphates.....	0.15
Sodium Erythorbate.....	0.035
	-----
	72.92%
Batter & Breading.....	27.08%
<b>Total Formula</b>	<b>100.00%</b>

\* Natural Pork Flavor supplied by Natural Flavors

**COST COMPARISON EXAMPLE:**

**All pork nugget vs. pork/surimi nugget**  
(per lb. of meat block only)

Meat Prices/lb. as of June 10, 1988:

**Pork**

**50's:**

Fresh .39  
Frozen .41

**80's:**

Fresh .79  
Frozen .81

**Picnics:**

Fresh .81  
Frozen .83

**Similar All Pork Nugget:**

50% 80s, 25% picnic, 25% 50s .71

**Surimi/Pork Nugget:**

85% 50s, 15% surimi (NON-ANALOG grade 2 or 3)  
assuming 1.10/lb. for surimi .50

**BEEF/SURIMI NUGGETS**

<u>Ingredient</u>	<u>¢</u>
Beef Trimmings (50% lean).....	48.66
Alaska Pollock Surimi.....	15.04
(Alaska pollock.....)	13.87)
(sucrose.....)	0.60)
(sorbitol.....)	0.53)
(sodium phosphate.....)	0.04)
Iced Water.....	7.30
Spice.....	1.28
Natural Beef Flavoring (#111017B)*.....	0.30
Curing Salts.....	0.15
(salt.....)	0.1458)
(sodium nitrite @ 6.25%.....)	0.0096)
Sodium phosphates.....	0.15
Sodium Erythorbate.....	0.035
	-----
	72.92¢
 Batter & Breading.....	 27.08¢
 Total Formula	 100.00¢

\* Natural Beef Flavor supplied by Natural Flavors

**CHICKEN/SURIMI NUGGETS**

<u>Ingredient</u>	<u>g</u>
White Trim.....	31.01
Alaska Pollock Surimi.....	15.04
(Alaska pollock.....)	13.87)
(sucrose.....)	0.60)
(sorbitol.....)	0.53)
(sodium phosphate.....)	0.04)
Dark Trim.....	14.62
Iced Water.....	7.30
Poultry Skin.....	3.03
Spice.....	1.28
Natural Beef Flavoring (#111017B)*.....	0.30
Curing Salts.....	0.15
(salt.....)	0.1458)
(sodium nitrite @ 6.25%....)	0.0096)
Sodium phosphates.....	0.15
Sodium Erythorbate.....	0.035
	-----
	72.92g
 Batter & Breeding.....	 27.08g
 Total Formula	 100.00g

\* Natural Chicken Flavor supplied by Natural Flavors

## Heating Instructions:

### Conventional Oven

Preheat oven to 350 F. Place frozen nuggets on a cookie sheet and bake for 15 to 20 minutes until done. Turn nuggets over halfway through heating time.

### Microwave Oven

Line microwave safe plate with paper towels. Place a single layer of frozen nuggets on towel. Heat uncovered on High for 2 minutes (up to 4 pieces), or for 3.5 minutes (4 - 6 pieces). Turn over halfway through heating time. When fully heated, remove from microwave and place on fresh paper toweling and let stand for 1 minute.

## Manufacturing Equipment:

- \* Grinder
- \* Blender (vacuum preferred with CO2 injection port)
- \* Square or Formax
- \* Appropriate dye design
- \* Standard batter & breading equipment (Koppens, Stein, etc.) including:
  - Pre-dust
  - Waterfall-type batter applicator
  - Japanese ("J" crumb) type applicator
  - Deep fat fryer
  - Nitrogen or CO2 freezing tunnel