ARROWTOOTH SURIMI PROJECT
PRODUCTION PAPER

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A technical description of arrowtooth flounder surimi production

Shortly after the fish were off-loaded on the morning of July 17, 1990, All Alaskan Seafoods (Kodiak, Alaska) made their entire flatfish processing room and crew available to process the arrowtooth fillets. Fish in the 13" to 19" category, which comprised the majority, were run through the Baader 175 mechanical flatfish filleter, with yields of approximately 38% to 42%. The fillets were then run through the Baader 47 or Baader 52 skinning machines, (positioned side-by-side in the production line), and were bagged, weighed and iced heavily in insulated totes. The totes were transferred to a 1°C to 3°C chill room at Alaska Pacific Seafoods (APS) for overnight storage.

The following morning, surimi production commenced. It was conducted by NMFS staff members Dr. Diana Wasson, Dr. Jerry Babbitt, Kermit Reppond and project technician Teressa Kandianis. APS made their existing surimi line available for the project. Production proceeded as follows:

Fillets were minced using the Baader 695 mincer, then washed in a 3:1 water-to-mince ratio using a rotary screen to dewater between washings. The washed mince was then refined and dehydrated using Fukoku equipment. Product coming off the screw press was immediately bagged, iced and transferred to the NMFS Utilization Lab at Gibson Cove, Kodiak, for blending with cryoprotectants and freezing later that night.

Comments on arrowtooth surimi production process

The washed mince dewatered and pumped easily. The major difference between arrowtooth and pollock surimi production was the greater quantity of congealed fish oil that floated to the surface of the wash tank. Despite the presence of more than 3% lipid in the mince, the resulting surimi contained less than 1% lipid. The final press cake from the screw press was 80% moisture and Hunter L values, used to measure the whiteness or brightness of the surimi, were higher than those of pollock surimi measured in the NMFS lab. After adding cryoprotectants, the resulting surimi was 74% moisture, the level generally considered ideal in the kamaboko industry.

Testing effectiveness of protease inhibitor on arrowtooth surimi

Surimi samples were prepared to test the effect of various food grade additives on the gel strength (the product of punch force and punch deflection), rigidity, shear stress and shear strain. Additives were tested when added along with cryoprotectants before freezing, as well as when added after freezing. In all cases duplicate samples were also prepared in which the water content was adjusted to correspond to that of the control surimi (with no added ingredients other than cryoprotectants). Powdered beef plasma (AMP), egg white (EW), carrageenan (XP) and two proprietary additives formulated by private industry were among the ingredients tested. For test purposes, the frozen surimi was tempered overnight in the refrigerator, then blended with 3% salt and/or other ingredients in a vacuum chopper, stuffed in polyvinyl chloride casings (gel strength tests) and stainless steel cylinders (torsion tests) then cooked at

90°C for 40 minutes. Subsamples of all treatments before and after cooking were also prepared for gel electrophoresis analysis.

Although the raw arrowtooth surimi displayed only a tenth the level of proteolytic activity observed in the unwashed mince when incubatd in the laboratory according to routine test procedures, the cooked surimi gave evidence of widespread myosin degradation. This degradation of the major myofibrillar protein resulted in extremely weak gels (approximately 130 g x cm) that would be unsuitable for commercial application. The addition of plasma powder at the 2% level or egg white powder at the 3% level resulted in gel strengths in excess of 1000 g x cm, and a combination of 2% plasma plus 2% egg white resulted in gel strengths in excess of 900 g x cm. There did not appear to be any appreciable gain in gel strength by increasing the level of plasma powder to 3%; this higher level of plasma was also problematic in terms of off-color and more pronounced odor. Addition of 1% carrageenan to 2% plasma gels did not increase gel strength as anticipated, but actually resulted in significantly lower scores than 2% plasma alone.

Examination of the gel electrophoresis and gel strength test data for these treatments compared to the results obtained after testing two other inhibitors proposed by private industry suggested that the increases in gel strength observed with both plasma and egg white were in excess of what might be expected from inhibition of the protease alone. The most probable explanation for this is that plasma and egg white both form gels independent of surimi, and probably form matrices with the fish proteins that have greater gel strengths than those of the fish proteins alone.

Statistical analysis and gel electrophoresis testing of the freshly produced arrowtooth surimi are still underway. We can say with certainty that it is possible to inhibit proteolytic degradation and produce a surimi with excellent functional properties, regardless of whether inhibitory substances are added at the time of surimi manufacture or kamaboko production. Should arrowtooth surimi find a place in commercial production, it would probably be prudent to add the inhibitors of choice at the time of surimi manufacture. In this way the gel strength would be a known quantity to the end users. At this time we also do not know whether time in frozen storage will have any effect on the timing of inhibitor addition, or how long the surimi will maintain this level of functionality. Repeat evaluation experiments are scheduled after three months of frozen storage, which will provide the answers to these questions. We are extremely encouraged with the results at this time.

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PARTICIPATING IN THIS PROJECT:
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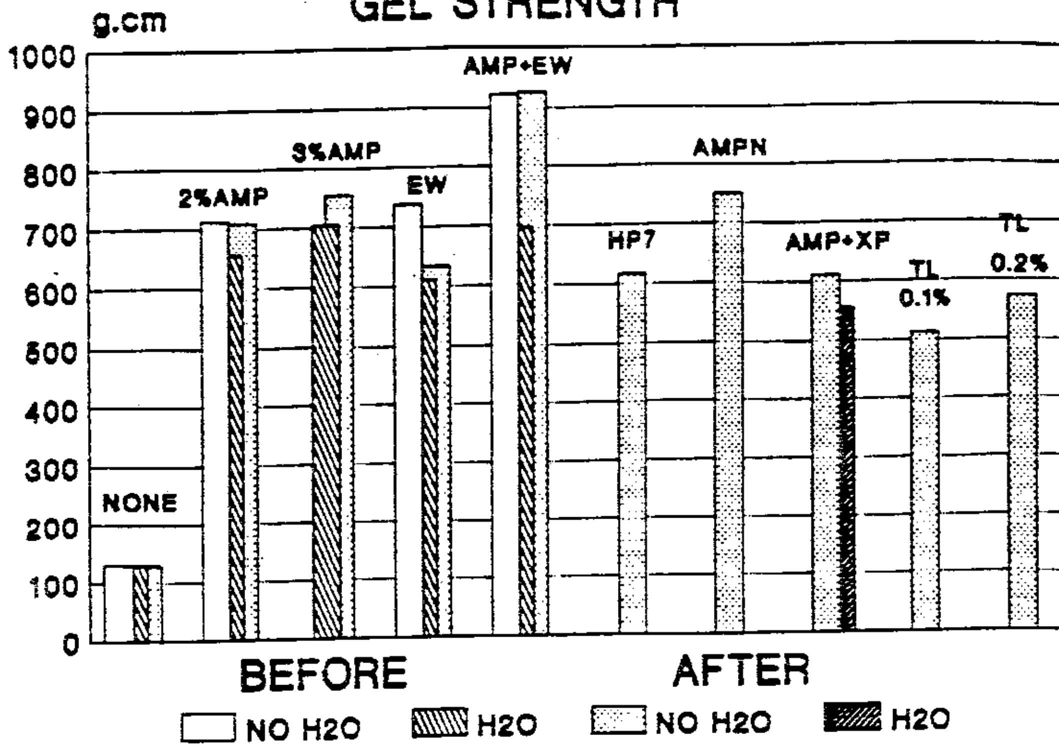
EFFECT OF INHIBITOR ON
GEL STRENGTH
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900
800
700
600
500
400
300
200
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0
NONE
2%AMP
3%AMP
EW
AMP+EW
HP7
AMPN
AMP+XP
TL
0.1%
TL
0.2%
BEFORE
AFTER
NO H2O
H2O
NO H2O
H2O