BOVINE CORIUM COLLAGEN AS AN INGREDIENT TO IMPROVE TEXTURAL PROPERTIES OF SURIMI GELS

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PURPOSE

The growing demand for surimi-based shellfish analog products has focused continued attention on the need to improve the textural quality of these products. The texture-modifying effects of starch, cellulose, hydrocolloids and nonmuscle proteins have previously been reported. [1, 2, 3, 4, 5] However, there are no reports in the literature on the effects of the mammalian protein collagen in this regard. Collagen is an ideal candidate for imparting unique textural properties to surimi gels because of its naturally occurring fibrous structure.

EXPERIMENTAL METHODOLOGY

Collagen was obtained from the corium layer of bovine skin by mechanically removing the grain layer and subjecting the corium to chemical treatments to remove non-collagen components and to neutralize the pH. This corium layer was sized into individual 1/4" cubes, combined with water and disintegrated in a Bauer mill to form a low solids collagen dispersion. This dispersion is characterized by its retention of relatively long intact native collagen fibers (Fig. 1). The collagen fibers are added to the surimi mix according to the following formula:

Collagen solids	3.5%
Surimi (Pollack)	62.0%
Water	25.0%
Starch	4.5%
Sugar	2.6%
Salt	1.65%
Flavor	0.75%

In the experimental work in developing the above formula, collagen solids levels were varied from a range of 1.0% to 10% in the surimi mix. In addition, products were prepared without starch and with soy protein additives.

The surimi mix was stuffed into 50mm diameter Vector plastic tubular casings and thermal processed at 90-92°C for 30

EXPERIMENTAL METHODOLOGY-(Continued)

To demonstrate the effect of the collagen additive on the natural qualities of the surimi analog, a penetrometer instrumental method was used and the data correlated with the response from an organoleptic taste panel. The penetrometer attachment used with the Instron Universal Testing Apparatus (Instron Corp , Canton, Massachusetts) is pictured in Figure 2. The penetrometer test measures the force requi l to penetrate a given distance into the surimi structure using a full scale load of 200 grams and a cross-head speed of 200 mm/minute. The penetrating blade measured 7.7 cm across and 0.2 cm in thickness.

Sensory evaluation of texture was conducted by a panel of seven individuals who had previously participated in the evaluation of similar products. They were asked to score four organoleptic characteristics (appearance, color, texture, and sliceability) for their overall desirability using a structured 9 point scale (1:least, 9:greatest).

RESULTS AND DISCUSSION

In all experiments collagen fiber added to surimi was found to increase Instron penetration force (firmness) vs. controls (no additive) or surimi containing soy protein (Figure 3). As the level of collagen increased and/or the fiber-length increased, greater force was recorded. Results correlated well ($r = 0.91$ to 0.96, $P<0.05$) with trained panel sensory scores. Panelists rated collagen-containing surimi products higher because of greater firmness, increased fibrosity and exhibiting a texture "more like the natural shellfish product being imitated" (Table I). The comments on sliceability also confirmed the increasing textural contribution of the collagen fiber. As higher levels of collagen fiber were added greater resistance to slicing was noted. In terms of product appearance and color, addition of collagen fiber improved whiteness and provided particulate matter which simulates the natural shellfish structure.

It will be noted from the test data that 10% collagen (solids equivalent) was found to be unsatisfactory in this application due to toughness and excessive clumping. A level of 3.5% collagen was judged to be overall the most acceptable product. As compared to surimi products containing isolated soy protein, the collagen additive was found to have increased whiteness and absence of off-flavors.

CONCLUSIONS

Industry is presently working with various functional additives to improve the texture of surimi analog products. These include starch, cellulose, and proteins. While some textural improvements have been demonstrated, there remains a need for an additive to provide greater fiber character to these products.

It has been demonstrated that relatively low levels of collagen fiber are effective in improving the textural properties of surimi analogs.
animal by-products, this additive can be produced and marketed at relatively low cost. Based on this initial study, it was concluded that bovine collagen fiber offers a unique approach to the continuing search for improved texture in surimi products and should be given further consideration by both academia and industry.

PERTINENT LITERATURE

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TABLE I: TRAINED PANEL EVALUATIONS OF SURIMI WITH VARYING LEVELS OF COLLAGEN TEXTURIZER ADDITIVE

ATTRIBUTES	A	B	C	D	E
Appearance	Smooth with some air pockets	Some visible particles, slight air pockets	Visible particles but very uniform appearance	Visible particles but very uniform appearance	Large particles and clumps, some gelatinization
Color	Off-white	Off-white	Some whiteness	Good levels of whiteness	Distinct high level of whiteness
Sliceability	Easy	Slightly easy	Some resistance	Considerable resistance	Very tough
Texture	Soft, easily compressed	Slight resistance to bite	Good resistance, like real tissue	Firm resistance	Very resistant Too firm, dry

Note: Panelists agreed best conditions will probably be between level C and D.
(1) A = Control, B = 1% Collagen Solids, C = 2% Collagen Solids, D = 5% Collagen Solids, E = 10% Collagen Solids

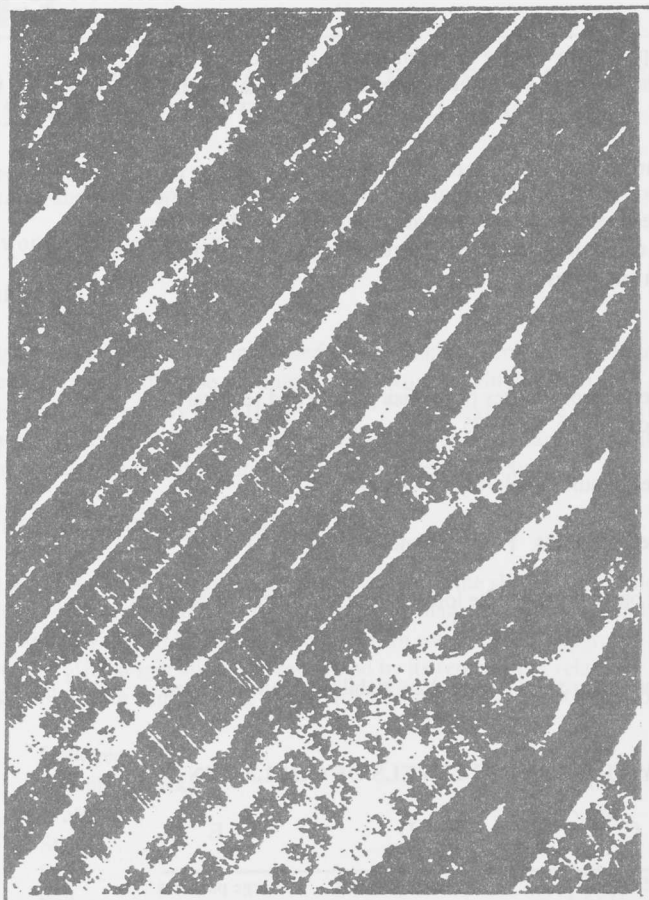

FIG. 1 - Electron micrograph of collagen fiber additive

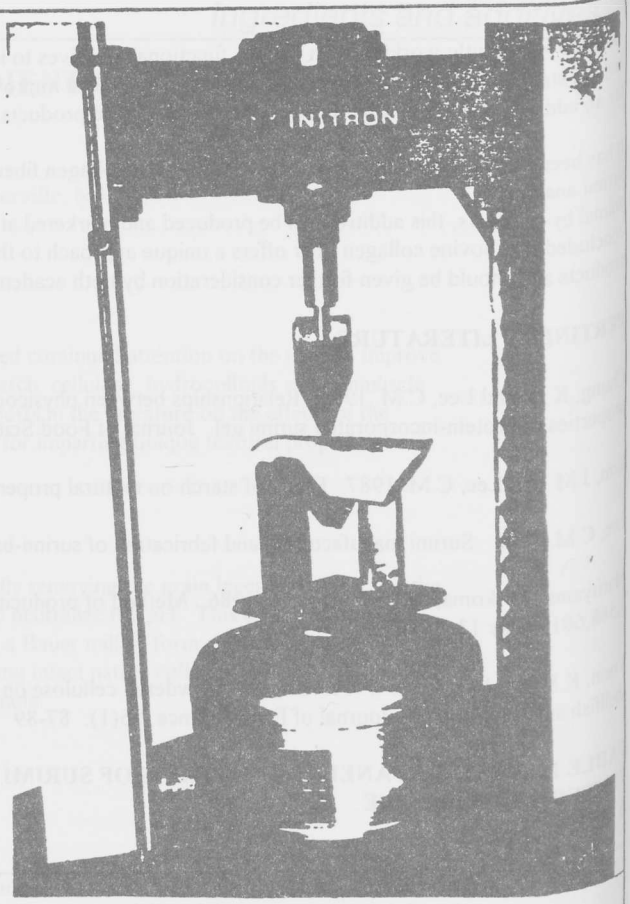

FIG. 2 - Penetrometer test using Instron apparatus

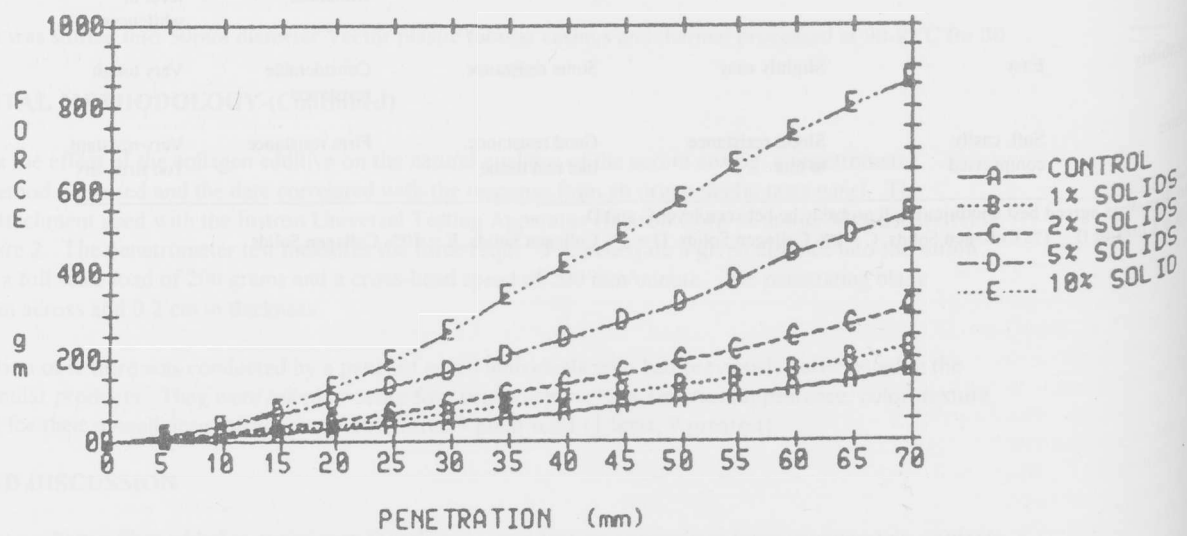

FIG. 3 - Effect of addition of varying levels of collagen on the textural properties of surimi product. Data obtained using Instron penetrometer to measure force (gm).