Fish By-Catch . . . Bonus From The Sea

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Fish By-Catch... Bonus from the Sea

Report of a Technical Consultation on Shrimp By-Catch Utilization held in Georgetown, Guyana, 27–30 October 1981

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Cod myosin can be denatured by salt concentrations of about 10%. It should be possible, therefore, to salt minced fish with less than the 25% salt previously recommended. Preliminary results show that less brine is released from lightly salted mince but that the physical and functional properties of the product are related to salt concentration.

Seafood laboratories throughout the world have been investigating the potential of minced fish to increase the supply of edible fish protein and to provide the means for utilizing shrimp by-catch and other non-traditional species of fish. Several international conferences have been held on the subject, and there has been general agreement that one of the major problems with the utilization of minced fish is the development of acceptable and marketable consumer products.

Recent work at Halifax has focused on the salting of minced fish, as Canada has traditionally been a major producer of salted fish and the product currently has a strong international market demand. Results of our earlier work were incorporated in a collaborative project of the government of Guyana and IDRC as the basis for production of salted, minced fish.

Many will recall the original studies done by Del Valle and co-workers. Del Valle and Nickerson (1968) published a quick-salting process for fish that entailed:

- Grinding fish muscle with salt;
- Mixing the salt–fish mixture;
a sudden increase of salt uptake and of moisture loss occurs.” From that observation, we considered it possible to produce lightly salted, minced fish with sufficient functional properties to enable the product to be formed into a cake or portion and therefore more closely resemble traditional salt cod.

**Experiment**

An experiment was designed to determine the effects of adding different quantities of salt to minced cod. Key factors considered in the study were protein functionality, colour, and water released from the tissue.

A standard test procedure was used wherein a fixed quantity of freshly prepared minced cod was mixed for 5 minutes with five different amounts of sodium chloride (at 5, 10, 15, 20, and 25% of the weight of the mince). The mixtures were then held at 35°C for 30 minutes and were stirred frequently. Released brine was collected through a Buchner funnel with vacuum while the tissue was being pressed to form a cake. The salted cakes were air dried at room temperature in a ventilated fume hood until a moisture content of 30–35% was obtained. Dehydrated cakes were sealed in laminated (polyethylene–aluminum foil) pouches for “curing” and subsequent analyses.

For comparative purposes, the various end-products were subjected to a series of laboratory tests. Protein contents were calculated from Kjeldahl nitrogen values. Sodium chloride levels were determined by conductivity and moisture values from weight losses after oven drying for 24 hours at 95°C. Colour was measured by a Gardner Automatic Color Difference Meter. The dried products were rehydrated by soaking (30-g samples in 10 volumes of water for 4 hours). Subsequent cooking involved boiling each sample in 75 ml of water for 3 minutes.

**Results and Discussion**

Under the experimental conditions employed, the results indicate that more than 10% salt is required for protein denaturation and the associated loss of water-binding capacity (Fig. 1). Although this level of salt is somewhat higher than that reported by Duerr

<table>
<thead>
<tr>
<th>Parameter</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
</tr>
</thead>
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<tr>
<td><strong>Composition (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Protein</td>
<td>55</td>
<td>50</td>
<td>48</td>
<td>44</td>
<td>44</td>
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<tr>
<td>Salt</td>
<td>15</td>
<td>20</td>
<td>22</td>
<td>26</td>
<td>26</td>
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<tr>
<td><strong>Colour</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Mean</td>
<td>62.9400</td>
<td>65.2857</td>
<td>68.5475</td>
<td>64.0875</td>
<td>67.9675</td>
</tr>
<tr>
<td>SD</td>
<td>±1.1914</td>
<td>±1.8396</td>
<td>±1.2768</td>
<td>±0.6581</td>
<td>±0.7467</td>
</tr>
<tr>
<td><strong>Water uptake</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight before soaking (g)</td>
<td>28.55</td>
<td>32.53</td>
<td>29.83</td>
<td>28.59</td>
<td>20.14</td>
</tr>
<tr>
<td>Weight after soaking (g)</td>
<td>46.99</td>
<td>45.22</td>
<td>54.16</td>
<td>43.94</td>
<td>42.76</td>
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<tr>
<td>Uptake (%)</td>
<td>39.24</td>
<td>28.06</td>
<td>44.92</td>
<td>34.94</td>
<td>31.85</td>
</tr>
</tbody>
</table>

*aScale 0–100 where 0 is black and 100 is white.

*bSoaked 4 hours at room temperature in 10 volumes of water.
and Dyer (1952), a time–temperature factor may be responsible.

In the composition of the dehydrated, salted, minced fish products (adjusted to 30% moisture content), the protein content is inversely proportional to the amounts of salt present; therefore, the product containing the least amount of salt contains the most protein (Table 1). Additions of salt at 20% and 25% yielded products saturated with salt, whereas 10% and 15% salt additions produced fairly heavily salted products. The results suggest little advantage in processing with more than 20% salt.

After drying to 30–35% moisture, the cakes were solid and could withstand normal handling without breakage. The cakes from the initial treatments with 5% and 10% salt had rough, coarse surfaces unlike the more fibrous appearance from the other treatments. The samples receiving the higher salt treatments were lighter in colour (Table 1) and, therefore, more closely resembled the natural colour of salted cod. On a scale of 0–100 (where 0 is black and 100 is white), the 15% salt treatment yielded a product at least as white as those from the two higher treatments.

After being stored in sealed pouches for approximately 3 weeks at about 20°C, the salted products acquired the traditional odour of salt-cured cod. The intensity of the odour seemed to increase with the amount of salt in the product.

As a first step in examining the functional properties of the salted products, we examined water uptake at rehydration. The results showed that the product treated with 15% salt had the greatest water-binding capacity (Table 1). Furthermore, this property was retained in the cooked product (Table 2). All samples held together and maintained their cake form throughout rehydration and cooking. Initial examination indicated that the 15% salt treatment yielded a lighter coloured product than did the others. This finding was confirmed by the Gardner Color Meter determinations (Table 2).

Preliminary taste-panel tests on the cooked products indicated that the samples had an acceptable flavour, closely resembling that of traditional salt cod, and that the 15% salt treatment sample appeared to have the best texture.

Although this study is continuing, early results have suggested that the addition of about 15% salt to lean, minced-fish tissue is sufficient to yield a product with superior properties.

This study was financed in part by a research grant from the Natural Sciences and Engineering Research Council of Canada.

Table 2. Composition and colour of rehydrated and cooked samples of salted minced cod.

<table>
<thead>
<tr>
<th>Parameter</th>
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<th>15</th>
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<td><strong>Composition (%)</strong></td>
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</tr>
<tr>
<td>Moisture</td>
<td>66</td>
<td>68</td>
<td>72</td>
<td>67</td>
<td>68</td>
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<tr>
<td>Protein</td>
<td>31</td>
<td>30</td>
<td>26</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>Salt</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td><strong>Coloura (L)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Mean</td>
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<td>60.824</td>
<td>65.574</td>
<td>62.446</td>
<td>61.880</td>
</tr>
<tr>
<td>SD</td>
<td>± 0.0981</td>
<td>± 0.8733</td>
<td>± 0.0760</td>
<td>± 0.9059</td>
<td>± 1.1140</td>
</tr>
</tbody>
</table>

asScale 0–100 where 0 is black and 100 is white.