BACTERIOLOGICAL EVALUATIONS OF RESTRUCTURED FISH PRODUCT PROCESSED BY TUMBLING WITH EGG WHITE

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It has been suggested that the fish industry should become much more innovative and produce an increasing number of interesting, value-added products for todays consumer. However, the consumer has always demonstrated an interest in being assured that the food supply is safe and wholesome. Previous microbiological analysis results have indicated that microflora of seafood products varies considerably. This flora both quantitavely and qualitatively depends on the living environment and harvesting technique used for the seafood (Foster et al., 1977; Love, 1988).

The flesh of healthy, living fish is sterile, but spoilage bacteria is usually introduced during capture, handling or contact with equipment or people, and the microorganism become established rapidly (Shaw et al., 1984). Fish might be a carrier of many spoilage and water-borne pathogenic bacteria which can generally be attributed to the following factors; (a) fish from polluted waters, (b) improper refrigeration, (c) improper sanitation procedures due to either facilities or handlers during the harvest or processing and (d) improper cooking. Obviously these factors effects not only shelf life but also microbial quality and wholesomeness of the product. Many research projects have been conducted to understand the microorganisms involved with spoilage and public health, and these studies must continue to seek ways to mitigate the effects of contamination and natural flora through effective surveillance or control techniques (Shewan, 1976; Abeyta, 1983; Liston, 1990). This research was undertaken to develop an understanding of level of contamination and the effects of processing on numbers, and to identify some organisms of concern (spoiler and pathogen) in a fish product which was tumbled in the presence of egg white.

MATERIALS and METHODS

a. Sample Preparation: Fresh Channel Catfish fillets were first inspected for any dirt or bones, diced (approximately 3x3x2 cm), and then sampled for fresh analysis. The treatment groups were: 1) non tumbled and no egg white added (control); 2) no egg white added and tumbled; 3) non tumbled and egg white added; and 4) tumbled and egg white added. A proper amount of ingredients [2% salt, 1% egg white powder (in egg white batches), 1% sucrose, 0.5% white pepper, 0.1% garlic, 0.25% sodium tri-polyphosphate, 0.01% nitrite and 0.01% natural lemon flavor] were mixed with the product. The intermittent tumbling procedure (40 min rest, 20 min work) was conducted for 12h at 6°C on tumbled batches, and non tumbled batches were stored for the same time in the same place. Then, each of the treatments was immediately sampled for bacteriological analysis, and the product was stuffed into casing and cooked until an internal temperature of 77 °C was attained. After cooling, the product was sampled again for thermophylic bacteria enumeration.

b. Bacteriological Analysis: American Public Health Association (APHA, 1992) procedure was used to identify and count the bacteria investigated or monitored in this research. A serial dilutions of the samples in 0.1% peptone water were plated in duplicate and incubated according to the procedures shown in Table 1. However, for the salmonella determinations the BAM (Bacteriological Analysis Manual) procedure was followed (FDA, 1984). Twenty five grams of the sample was first enriched in Selenite Cystine broth, and then streaked on prepoured agar (XLD and BSA) plates. The suspicious colonies were subjected to further biochemical evaluations for confirmation.

c. Experimental Procedure and Statistical Analysis: Fresh fish fillets and 4 different treatments (non-tumble and tumble fish muscle with or without egg white) were tested. The experiment consisted of a (1x2x2) factorial block design (fresh,

tumbling and egg white) with five replications. The individual fish batches are considered as a block, and ANOVA techniques were applied to the logarithms (base 10) of the bacterial numbers. Differences in treatment means and correlations were determined using SAS (SAS, 1985). Duncan's multiple range test was used for multiple comparison of means (Duncan, 1955). Additionally, if no interaction term was signifant, tumbling and egg white treatments data were combined where appropriate, and another statistical analysis was performed on the treatments to see the influence of these factors.

RESULTS AND DISCUSSION

As can be seen from Table 2, there was significant changes in bacteria numbers between the treatments and fresh sample. Total Aerobic bacteria (APC) number was higher in fresh tissue compared to the processed groups and, it was lowered with the tumbling process. The reason for this reduction in the processed treatments might be the curing ingredients such as salt, nitrite, phosphate, sugar and garlic which may cause an inhibition on colony forming units (APHA, 1992). Total psychrophilic bacteria number continued to increase during processing probably due to processing temperature which was 6 °C, but the increasing rate was not very high in the tumbled treatments. Also, pseudomonas bacteria numbers were low in the tumbling process samples when compared to the original (in fresh fish) number, and it was also lower than the non-tumbled counterparts. In general, a lower bacterial number was determined in the tumbled groups compared to the non-tumbled treatments. The reason for this outcome might be a faster cure distribution or penetration into the muscle pieces (Mills et al. 1980; Knipe et al. 1981; Leak et al, 1984). However, coliform, proteolytic and lipolytic bacteria numbers were higher in processed groups irrespective of the treatments although tumbling showed a slightly lower bacterial

count. The reason for this result might be unexpected contamination during the processing either from equipment or ingredients used in this study. Thermophilic bacteria numbers were quite low and were not significantly different among the treatments. Also, none of the samples including fresh tissue was salmonella positive in the treatments although there are many reports of salmonella incidence in seafood and fish products (Taylor, 1988; Garret, 1988; Liston, 1990; Nickelson, 1992).

The results obtained from the other statistical analysis in which the data was pooled is shown in Figure 1 and 2. As can be followed from Figure 1, egg white had no effect on the alteration of the bacteria enumerated in this research. However, tumbling had a significant effect or retarding proliferation of the bacteria enumerated in this study. The significant differences were in APC, pseudomonas, lipolytic and proteolytic bacteria numbers probely due to better distribution of the cure ingredients with the tumbling process.

CONCLUSIONS

The utilization of tumbling significantly altered the bacteriological properties of restructured fish product during processing. Tumbling decreased APC, pseudomonas, proteolytic and lipolytic bacteria number while egg white addition had no significant effect on the enumerated bacteria. There were significantly positive relations between pseudomonas and proteolytic bacteria, and between total psychrophiles and pseudomonas numbers. Also, there was significant positive correlations between APC and pseudomonas bacteria numbers. These results confirm that the dominant bacteria genus in seafood was pseudomonas which agrees with previously reported research by Shewan, 1976; Hobbs, 1983; Ward and Baj, 1988. It could be concluded from the bacteriological evaluation results that tumbling would be a useful technique to improve the microbial quality of fish products during processing.

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