2014 3rd International Conference on Nutrition and Food Sciences
IPCBEE vol. 71 (2014) © (2014) IACSIT Press, Singapore
DOI: 10.7763/IPCBEE. 2014. V71. 1

Seasoning Sauce Fermentation Using Tuna Processing Waste

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Abstract. Tuna viscera were sources of enzyme and protein in tuna processing waste. The objective of this research was to produce seasoning sauce using tuna processing waste. Skipjack viscera were fermented in 0, 5 and 10% salt at room temperature. The 0% salt fermentation contained higher protein content than the sample at 5 and 10%, respectively. The best conditions for skipjack viscera fermentation were 0% salt for 5 days. The seasoning sauce contained amounts of crude protein, salt and fat of 18.62±0.14, 1.83±0.99 and 0.59 ± 0.24%, respectively. It contained essential amino acids, histidine, isoleucine, leucine, lysine, methionine, phenylalanine and tryptophane. The level of histamine (267.66 mg / kg) was below the level the safe level for human consumption. The seasoning sauce was brownish-yellow color which was different from anchovy fish sauce.

Keywords: seasoning sauce, tuna processing waste, tuna viscera

1. Introduction

Thailand is the biggest canned tuna producer and exporter in the world. Waste treatment and management are substantial expenses for tuna processing companies. These wastes (head, bone, viscera and etc.) are protein sources for the production of by-products such as fish meal and protein concentrate. Viscera are sources of enzyme and protein. Tuna viscera contain about 10 % protein that should be a good source for seasoning sauce fermentation. The objective of this research was to produce seasoning sauce using tuna processing waste.

2. Materials and Methods

2.1. Raw Materials

Viscera of skipjack tuna (*Katsuwonous pelamis*) and albacore tuna (*Thunnus alalunga*) obtained from Thai Union Frozen Products PCL (Thailand), Samutsakorn, Thailand.

2.2. Selection of Material for Seasoning Sauce Fermentation

Skipjack and albacore tuna viscera were fermented at room temperature (35°C) for 10 days. The fermentation liquid was sampled every day using a centrifuge at 20,000 xg for 30 min. The soluble protein content of the fermentation liquid was determined [1] using bovine serum albumin as protein standard. The treatment that gave the highest protein concentration liquid was selected for seasoning sauce fermentation.

2.3. Seasoning Sauce Fermentation

The chemical composition of selected raw material was determined. The crude protein content was calculated by converting the nitrogen content determined by Kjeldahl's method (6.25xN) [2]. The moisture, ash, fat contents were determined [3].

Selected tuna viscera were fermented in 0, 5 and 10% salt at room temperature for 10 days. Fermentation liquid was sampled every day using a centrifuge at 20,000 xg for 30 min. Soluble protein content of

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fermentation liquid was determined [1], salt content and pH of fermentation liquid were determined [2]. The highest protein concentration of salt treatment will be selected for seasoning sauce fermentation.

2.4. Quality Determination of Seasoning Sauce

2.4.1. Chemical analysis

The crude protein, salt and fat content and amino acid composition in seasoning sauce were determined [2]-[4]. The histamine contents in the raw material and the seasoning sauce were analyzed [5].

2.4.2. Color measurement

The color of fermentation liquid was determined using Minolta CM-3500d Spectrophotometer.

2.4.3. Sensory evaluation

A nine-point hedonic scales (from 1 representing extreme dislike to 9 representing like extremely) was used in the acceptance evaluation of the seasoning sauce. The analysis was carried out with 50 untrained panelists (aged from 19 to 22 years) who were under-graduated and graduated from the Department of Fishery Products, Kasetsart University.

2.5. Statistical Analysis

A completely randomized design was used throughout the study, and the experiments were done in triplicate. Data were subjected to analysis of variance and mean comparisons were carried out using Duncan'smultiple range.

3. Results and Discussion

3.1. Selection of Material for Seasoning Sauce Fermentation

The soluble protein content of fermented skipjack viscera was higher than in albacore (Figure 1). Skipjack tuna viscera was selected for seasoning sauce fermentation. Fish sauce is basically protein hydrolysate resulting from natural fish fermentation. Protein hydrolysis is induced by proteases in fish muscle, digestive tract and halophilic bacteria [6].

3.2. Seasoning Sauce Fermentation

Skipjack viscera contained protein, fat, moisture and ash contents of 17.51±0.30, 2.60 ± 0.37, 74.51 ± 0.13 and 1.90±0.20%, respectively.

The pH of the different results from seasoning sauce fermentations was between 6-and 8 (Figure 2). The degradation of fish protein into free amino acids and biogenic amines was responsible for the delicious taste [7] and the pH of the fish sauce. The initial bacteria produced the amine product. The addition of salt (5 and 10%) could inhibit bacterial growth.

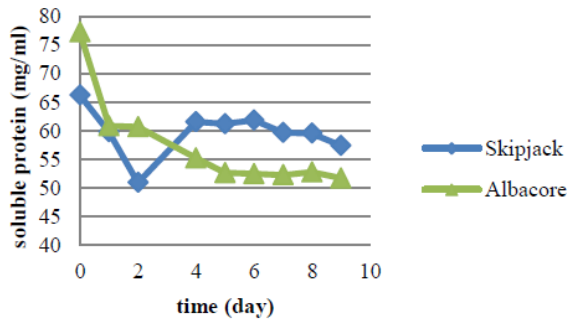

Fig. 1: soluble protein changes in seasoning sauce fermentation

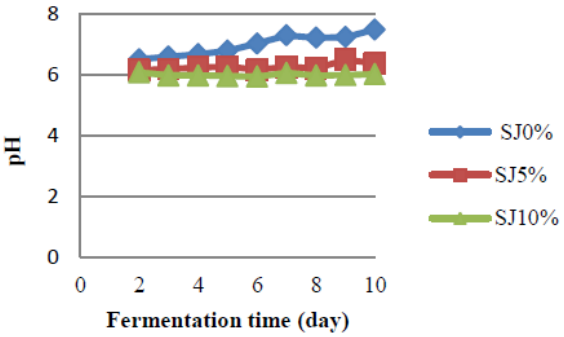

Fig. 2: Change in pH during seasoning sauce fermentation

The total soluble protein increased as fermentation was progressed (Figure 3). The soluble protein content with 0% salt in the fermentation was higher than for salt level of 5 and 10%, respectively. The salt concentration effected growth especially protease bacteria [8].

3.3. Quality Determination of Seasoning Sauce

The skipjack tuna viscera that was fermented with 0% salt for 5 days produced the best conditions for seasoning sauce fermentation. The seasoning sauce contained amount of crude protein, salt and fat of 18.62±0.14, 1.83±0.99 and 0.59 ± 0.24%, respectively. It contained 8 essential amino acids, histidine, isoleucine, leucine, lysine, methionine, phenylalanine and tryptophane (Table I).

The histamine content in the seasoning sauce increased from 32.78 in the raw materials to 267.66 mg/kg, but was lower than histamine maximum levels in the fish sauce (400 mg/kg) [9].The increased histamine content in fish sauce came from the raw material and occurred during fermentation [10]. The histamine content increased as the fermentation time progress. A short fermentation time reduces the risk of unacceptably high histamine level [11].

The seasoning sauce was a brownish-yellow color (L* = 39.92 a* = 29.33, b*= 66.17) as shown in Figure 4. The color was lighter than anchovy fish sauce perhaps as a result of the different chemical composition of the raw material.

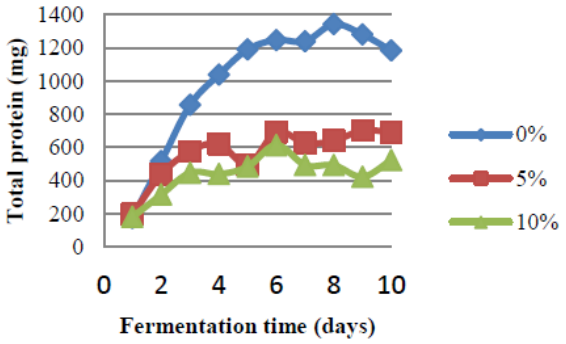

Fig. 3: Total soluble protein changes in seasoning sauce fermentation

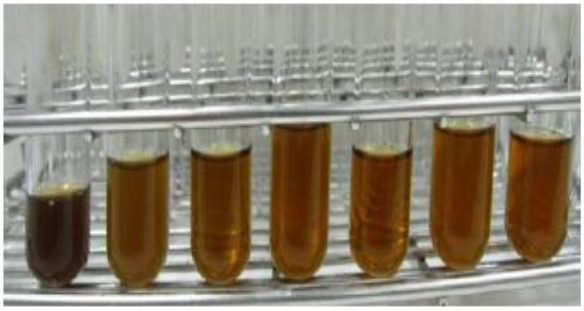

Fig. 4: Color of seasoning sauce

Table I: Amino acid composition of seasoning sauce Amino acid

Amino acid	Amount (mg/100ml)
Alanine	884.07
Arginine*	Not Detected
Aspartic acid	949.71
Cystine	Not Detected
Glutamic acid	1493.81
Glycine	746.47
Histidine*	240.87
Hyproxylysine	Not Detected
Hyproxyproline	Not Detected
Isoleuine*	602.30
Leucine*	933.31
Lysine*	1047.52
Methionine*	375.27
Phenylalanine*	333.13
Proline	71.60
Serine	Not Detected
Threonine*	62.10
Tryptophan*	89.63
Tyrosine	Not Detected
Valine*	651.14

* essential amino acid

The overall product liking score for sauce prepared using 0% salt was higher than for the sauces with 5 and 10% salt, respectively (Table II). Its odor was similar to anchovy fish sauce.

Table II: Overall product liking score of seasoning sauce

%Salt treatment	Overall product liking score
0	6.8±0.63
5	2.5±1.35
10	1.5±1.05

4. Acknowledgements

The authors would like to thank Thai Union Frozen Products PCL (Thailand) for the provision of the raw materials.

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