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The Differences of Using Electrical and Mechanical Oven to the Quality Characteristics of Liquid Smoked Milkfish (*Chanos chanos* Forsk)

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Abstract. This research was aimed to find out the effects of using electrical (A_1) and mechanical oven (A_2) to the quality of liquid smoked milkfish in terms of moisture content, TMA, PV, TVB and TBA value. All bones of fish were removed prior dipped for about 15 minutes into 5% of coconut shell liquid smoke; then divided into two groups. One group was dried by using an electrical oven and the other was using a mechanical oven within $\pm 80^0$C temperature for about 3 hours. The results of T-Test data showed that the differences in drying methods gave some quality differentiation of liquid smoked milkfish ($P<0,05$). The moisture content of A_1 sample was found 55.29%±0.38 whereas A_2 sample was 51.80±0.52. In terms of TMA content, A_1 sample was found 56.91 mg nitrogen/100 gr±0.23; and A_2 sample was 55.23 mg nitrogen/100g±0.45. PV; TVB; and TBA value of both samples (A_1 and A_2) were found 1.95 mleq/kg±0.034 and 2.01 mleq/kg±0.06; 100.79 mgNH_3/100g±1.06 and 118.56 mgNH_3/100g±2.67; 2.38 mg malonaldehid/100g±0.02 and 4.02 mg malonaldehid/100g±0.006 respectively. Generally smoked fish processed with an electrical oven is better than a mechanical oven due to quality characteristics changes controlling during smoking.

Keywords: boneless smoked milkfish, electrical oven, mechanical oven, quality

1. Introduction

Smoking method using liquid smoke has already being implemented in Indonesia, as it could produce a high quality product and the processes are safetier. Liquid smoke is considered as a substitute to traditional smoking method and could give strong flavour and colour to the products [1], [2]. Smoking is an old method that plays an important rolein case of quality characteristics changes; it usually done by three processes; salting, deposition of smoke components (smoking) and drying. Some woods smokes contain many different components such as aldehydes, ketones, alcohols, acids, hydrocarbons, esters, and phenols. Phenolic compound and its derivatives play an important role as food antioxidants [3], [4]. Corn cob liquid smoke was used to the smoking process of milkfish to inhibit the growth of pathogenic bacteria which cause a lipid oxidation [5], [6]. Smoked Milkfish (*Chanoschanos*Forsk) contains a high nutrition value and has a spesific taste, and it is highly acceptable by Indonesian people [7]. Trimethylamine; Peroxide value; total volatile base; and thiobarbituric acids are the most common parameters used to determine lipid oxidation [8], [9], and [6]

2. Materials and Methods

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2.1. Smoking process

A total of 10 kg of boneless milkfish bought from Semarang traditional fish market was used as samples in this experiment. The fish were smoked in the Laboratory of Fish Processing Technology, Diponegoro University, according to the Indonesia's National Standard's procedure, 2013. The fish were washed thoroughly and dipped into 5% of salt and 5% of liquid smoke solution for about 3 hours, then divided into two groups. One group was dried by an electrical oven (A_1) while the other was dried by a mechanical oven (A_2).

2.2. Moisture content

Fish samples that had been dried by an oven for ± 24 hours at $100^0C \pm 5^0C$ until the weight of samples remained constant, then prepared to find the percentage of moisture content that was calculated based on formula [10]:

$$\frac{dry\ weight}{wet\ weight}\ x\ 100\% \quad (1)$$

2.3. Trimethylamine value

Fish samples were extracted with 7% of trichloro acetic acid solution, then added with 37% of formaldehyde, put it in the Conway's dish, and then incubated at a temperature of 35^0C for 2 hours or at ambient storage for a night, base nitrogen were absorbed by 2% of H_3BO_3 solution. The absorbing colour had been counted with titration method using 0.02 N of HCl solution [10].

2.4. Peroxide value

5 g of samples were extracted with 500 mg methanolin the250 ml Erlenmeyer; then added with 30 ml acetic acid: chloroform : ethanol (4 : 9 : 5) mixture, and 1 gram of potassium iodide. Then it was kept in the dark place for 30 minutes. Thenthe samples were added with 30 ml of distilled water and starch solution. The result was then titrated with 0.02 N sodium thiosulphate until the blue colour disappeared [10].

2.5. Total volatile base

10 g of samples were extracted with 6% of perochloric acid. It was then added withNaOH 20% and then being distilled. The destillatedsolution was put into 3% of H_3BO_3 solution. The concentration of TVB was measured by titration with 0.02 N of HCl [10].

2.6. Thiobarbituric acid

5 grams of samples were weighed and homogenized with 50 ml aquadest; then filled into distillation tube and added with 2.5 ml 4N HCl until the pH of 1.5. Then the sample was heated for about 10 minutes until the volume decreased to 50ml. After being mixed; the destilated solution then filtrated and took 5 ml of it into 50 ml closed Erlenmeyer. 5 ml of TBA reagent was then added and heated for 35 minutes. The tube was then kept in a low temperature to measure the absorbance in 528 nm wave length and finally TBA value calculated with number of TBA (7.8D) [10].

Table 1: The Quality Characteristics of Boneless Smoked Milkfish

Quality	Electrical (A_1)	Mechanical (A_2)
Moisture (%)	55.29%±0.38	51.80±0.52
Trimethylamine (mg nitrogen/100 gr)	56,91±0,23	55,23±0,46
Peroxide value (mleq/kg)	1.95±0.034	2.01±0.06
Total Volatil Base (mgNH_3/100g)	100.79±1.06	118.56±2.67
Thiobarbituric acid (mg malonaldehid/100g)	2.38±0.02	4.02±0.006

2.7. Statistical analysis

The collected data from three replications was subjected to *t-test* determining the differences between treatments using the SPSS 16. Significantly the treatment differences means were further separated using the Least Significant Difference method and it was reported at $p<0.05$ with means ± deviation standard.

3. Result and Discussion

The result of boneless smoked milkfish in terms of quality characteristics with A_1 and A_2 showed variation in chemical composition (Table 1). It can be indicated that the changes on quality characteristics of smoked fish was affected by the different dried tools.

3.1. Moisture content

Two different types of drying oven gave different ($p<0.05$) effects to the moisture content of boneless smoked milkfish. As it can be seen in the table1, the moisture content of A1 sample was lower than A2 sample (Fig. 1). Research by [5], showed that the two different drying methods gave a significant different ($P<0.05$) moisture content i.e. 58.33% and 63.37% respectively. The moisture content of both boneless smoked milkfish (A_1 and A_2) was in the range of Indonesian National Standard of smoked fish which is 60% of maximum. Moisture content in this study had been decreased for about 4.71%-8.20% during smoking process. The reduction of moisture content was also influenced by smoking temperature and drying process [11]. The means of moisture content in the total liquid loss from the smoked salmon were significantly affected along the process becauseof a significant extraction of water during salting and reduced water in the muscle tissue [12].

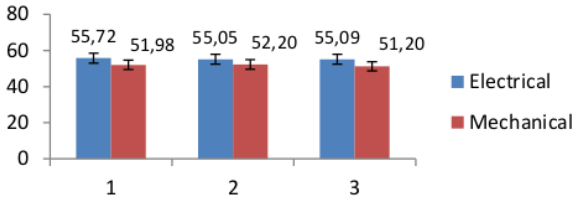

Fig. 1: Moisture content of boneless smoked milkfish

3.2. Trimethylamine

The results of TMA value of boneless smoked milkfish dried by electrical and mechanical oven (Table 1) showed significant differences ($P<0.05$). It was indicated that the changes on TMA of smoked fish was affected by different methods of drying, with electrical or mechanical oven (Fig. 2). The different value of TMA was caused by a combination of microbiological and autolytic deamination of amino acids and temperature of smoking; increasing storage temperature resulted in higher TMA value [13].

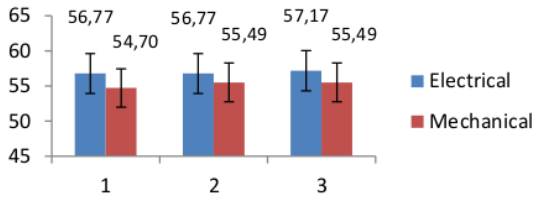

Fig. 2: TMA value of boneless smoked milkfish

3.3. Peroxide value

The content of peroxide value determined in the boneless smoked milkfish. The peroxide value of A_1 sample was lower than that of A_2 sample (Fig. 3). Study by [14], showed that the peroxide value (mleq/kg) average of smoked stingray during storage at 0; 3; and 6 days were found 2,82±0.03; 7.49±007; 5.45±0.05 respectively. It showed that the slow rate of oxidation during storage might be due to the effectiveness of the smoke antioxidants as the function of phenolic compound.

3.4. Total volatile base

The results of TVB value of A_1 and A_2 samples showed differentiation ($P<0.05$). The TVB value of A_1 sample was lower than A_2 sample (Fig. 4). TVB is potential chemical quality indicators for the production of trimethylamine [8]. In contrast, TVB values remained practically associated with lower moisture content,

higher salt level and deposition of antimicrobial smoke constituents (i.e. phenols, formaldehyde, aldehydes) on smoked fish [9].

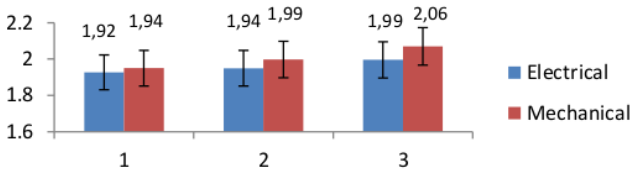

Fig. 3: Peroxide value of boneless smoked milkfish

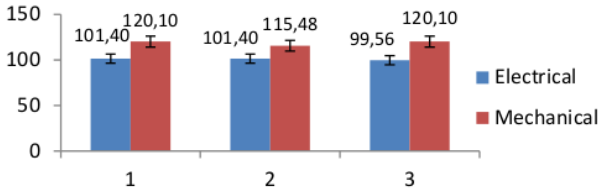

Fig. 4: Total volatile base of boneless smoked milkfish

3.5. Thiobarbituric acid

The means TBA values of A_1 sample was found lower than A_2 sample (Fig. 5). Different drying methods (electrical and mechanic) gave differentiation to TBA value ($P<0.05$). Study by [15] found that TBA value of smoked tilapia using corncob liquid smoke was higher than using coconut shell liquid smoke during storage at 0; 5; and 10 days respectively (0.76±0.01; 0.74±0.02; 1.02±0.07; 0.95±0.02; 1.42±0.02; 1.32±0.02).

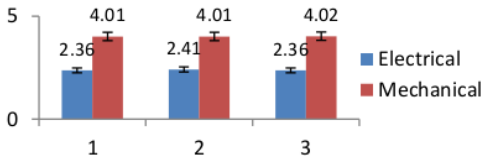

Fig. 5: Thiobarbituric acid of boneless smoked milkfish

4. Conclusion

Corncob liquid smoke was able to control lipid oxidation (i.e. TMA; PV; TVB; and TBA) at room temperature. Electrical oven was found more effective in maintaining an oxidation process of boneless smoked milkfish comparing to the mechanical oven as it completed by following temperature control and air circulation system.

5. Acknowledgment

We would like to thanks The Directorate of Higher Education, Ministry of Education and Culture, Republic of Indonesia for financial supported in this research.

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