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Quality Characteristic and Lysine Available of Smoked Fish

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Abstract

The purpose of this research was to determine the quality of smoked stingray (*Dasyatis blekery).* The fish were divided into two groups; then processed using corncob (CCLS) and coconut shells (CSLS) liquid smoke. All of smoked stingray samples were subjected to sensory and chemical analysis. Sensory analysis on both samples was no statistically different. On the other hand, the lysine availability was different either in the in the raw materials or smoked samples due to smoking process and duration of storage. Different liquid smoke and storage time gave significant effect to lysine availabilty ($p<0,05$). Both liquid smoke gave significant effect ($p<0,05$) to PV (CSLS = 2,816 meq/kg & CCLS = 2,195meq/kg) and TBA (CSLS = 109,685 mg malonaldehide/kg & CCLS = 45,169 mg malonaldehide/kg), but during storage this value were decrease as an effect of antioxidant activities of phenolic compounds consist in each liquid smoke. In contrast, pH values were increase. Both liquid smoke were able to apllied as a method of smoking fish.

Keywords: Stingray, Coconut shells liquid smoke, Corn cob liquid smoke, Quality, Lysine.

1. Introduction

Smoking method mostly imparts a desirable flavour and inhibit the growth of microbe. One methods that becoming popular nowadays is the use of liquid smoke. According to Martinez *et al.* (2007), liquid smoke has

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some advantages such as they are easily to applied, the concentration of liquid smoke can be controlled, resulted uniformity products and less taxing on the environment. In related to consumer preferences, it is indicated that consumers do not like the same kind of products. For example some people require a strong smoke odour and flavour, others want a specific “wood” or smoke materials (Sunen, 2001; Cardinal *et al.*, 2006).

The possible materials used in the production of liquid smoke in Indonesia are corncob and coconut shells, due to their specific characteristics in chemical compound. Stingray is one of the most acceptable and popular fish species to be smoked in Indonesia especially processed by traditional method. Accurate shelf life information convinces consumers and improves the quality of product (Sikorski *et al.*, 1998). The objective of this research was to determine the effects of two different liquid smoke flavourings on the sensory and chemical characteristics of stingray during storage at ambient temperature.

2. Materials and Methods

2.1. Production of Liquid smoke flavouring

About 100 kg of Corncob and Coconut shells were used as raw materials of liquid smoke processed by destilation system. The machine is set into the temperature of $\pm$ 250^0 C.

2.2. Smoking process

A total of 9 kg of stingray collected from Semarang fish market were used in this experiment. The fish were smoked in The Laboratory of Fish Processing Technology following the procedure of Standar Nasional Indonesia, 2006.

2.3. Laboratory analysis

In order to evaluate quality characteristic of liquid smoke and smoked fish some chemical analysis i.e : hydrocarbon components, sensory analysis, proximate (SNI 01-2354-2006), pH, Thiobarbituric acid, lysine and PV (SNI 01-2347-1991) were investigated.

2.4. Statistical analysis

The collected data from two replications was subjected to a *t* –test to determine the differences between corncob liquid smoke and coconut shells liquid smoke (independent variable) for each parameter using the SPSS 11. Significantly different treatment means were further separated using the Least Significant Differences method and significance was reported at $p < 0.05$ with means ± deviation standard.

3. Results And Discussion

3.1. Liquid smoke characteristics

Both corncob and coconut shells liquid smoke, have some similarities and differences characteristics. Major component found in Corncob liquid smoke were dominated by three compound namely propanoic acid, 2 furan methanol and phenol. Meanwhile, coconut shells liquid smoke were dominated by phenol,2-methoxy; phenol,2,6,-dimethoxy; and pyrazole,1,4-dimethil. Guillén and Manzanos (1999) reported that thyme liquid smoke were contained the main components of 2-furancarboxaldehyde; 2-furanmethanol; 3-methyl-1,2-cyclopentanedione; 1-acetoxy-propan-2-one and 3-methyl-2butanone.

Table 1. Percentage of major carbonyl derivatives in corncob and coconut shells liquid smoke.

No	**Carbonyl derivates**	**Liquid Smoke**	
		Corncob (%)	**Coconut shells (%)**
1	1,2-Benzenediol *(H)*	3.08	6.76
2	2-Cyclopenten-1-one,2-hidroxy-3-methyl	4.34	3.93
3	2-Furanmethanol *(A)*	13.51	3.84
4	Phenol,2-Methoxy-4-methyl- *(P)*	2.86	3.45
5	Phenol *(P)*	**9.72**	-
6	Phenol,2,6-dimethoxy *(P)*	2.27	8.99
7	Phenol,2-methoxy *(P)*	9.47	12.69
8	Phenol,4-ethyl-2-methoxy *(P)*	2.52	7.17
9	Phenol,2-methyl *(P)*	3.31	2.71
10	Pyrazole,1,4-dimethil	6.47	8.05
11	Hexadecanoic acid *(a)*	0.9	0.71
12	Propanoic acid *(a)*	17.53	-

3.2. Sensory characteristic during storage

In general, smoked stingray treated by CCLS received slightly higher sensory scores of than CSLS treatment. These indicates that the colour of smoked fish caused by decomposition carbonyl amino and it has correlated with the decreas in carbonyl group during storage. Phenol is substances that play an important role in the desirable characteristic of flavor and odour on smoked fish (Girard, 1992; Cardinal *et al.*, 2006). Taking only sensory qualities into account, the samples were rejected by the panelist when they showed characteristic of softening, low elasticity, firmness, discolouration and low brightness. All samples were rejected at 4 days of storage in room temperature.

3.3. Chemical characteristic during storage

3.3.1. Proximate

The results of proximate analysis on raw materials and smoked fish indicated variation on chemical composition (Table 2). It was indicated that the changes on proximate composition of smoked fish was affected by the chemical compound of liquid smoke.

Table 2. The gross chemical composition of smoked stingray

stingray	Moisture (%)	Crude Protein (%)	Lipid (%)	Ash (%)
Raw	73,78 ± 0,06	21,00 ± 0,21	2,40 ± 0,37	1,44 ± 0,40
	Smoked (with liquid smoke treatment)			
Coconut shells liquid smoke	61,47 ± 0,33	33,73 ± 0,04	1,84 ± 0,26	3,58 ± 0,36
Corn cob liquid smoke	66,50 ± 0,63	32,54 ± 0,09	2,06 ± 0,08	2,860 ± 0,37

3.3.2. Lysine

The lysine content on raw material and smoked fish (Table 3) were generally comparatively lower than the level of Kolodziejska *et al.*, (2004).

Table 3. The effect of room temperature storage on available of lysine in smoked stingray

Stingray	Storage Time (Days)		
	0	3	6
Coconut shells liquid smoke	1,38 ± 0,42	1,35 ± 0,01	0,87 ± 0,00
Corn cob liquid smoke	1,65 ± 0,00	1,10 ± 0,01	0,41 ± 0,00

On raw material, The lysine content of fresh stingray was 0,28. They were then increased as an effect of smoking process but gradually decreased during stirage. Changes in lysine can be caused in part by the Maillard reaction (Kolodzieska *et al.*, 2004). In addition, the crooslinking of the heated protein cause the reaction on lysine with other component on food (Fayle *et al.*, 2000). Storage time gave statistically significant effect ($p < 0,05$) on lysine availability of both samples. Dvorak and Vognarora (1965) *in* Girard (1992) reported a loss of 12,2 % of lysine in smoked fish in the cold air for 2 days.

3.3.3. PV

The results showed that peroxide values tends to decrease during storage.

Table 4. The effect of room temperature storage on Thiobarbituric acid (TBA), pH, and Peroxide Value

Stingray	Storage Time (Days)		
	0	3	6
Coconut shells liquid smoke			
TBA (mg malonaldehide/kg)	109,69 ± 0,36	37,14 ± 1,58	15,48 ± 0,36
pH	7,30 ± 0,00	8,30 ± 0,00	8,30 ± 0,00
Peroxide value (miliequivalent/kg)	2,82 ± 2,20	2,20 ± 0,04	0,82 ± 0,00
Corn cob liquid smoke			
TBA (mg malonaldehide/kg)	45,17 ± 0,77	18,79 ± 0,47	42,01 ± 0,42
pH	8,20 ± 0,00	8,50 ± 0,00	8,20 ± 0,00
Peroxide value (miliequivalent/kg)	2,20 ± 0,03	7,49 ± 0,07	5,45 ± 0,05

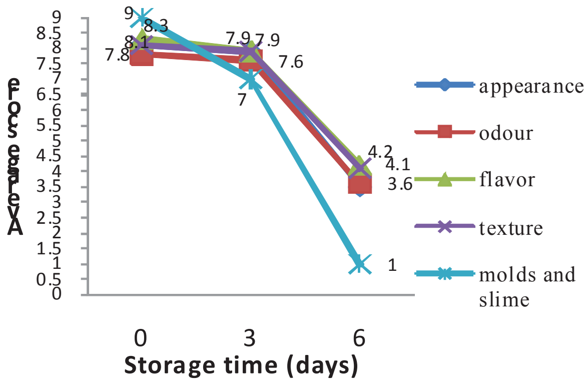
The slow rate of oxidation during storage might be due to the effectiveness of the smoke antioxidants (Kolodziejska *et al.,* 2004). Similarly, Medina *et al.* (1999) reported that lipid oxidation on tuna samples, have a higher rate during the first day of storage at 40^0C while after this period, PV decreased significantly as of result of peroxide decomposition. Peroxide value correlates well with sensory analysis of rancidity (Huss, 1995). Smoking process can influence on lipid oxidation as the function of phenolic compounds (Kolodziejska *et al.*, 2004).

3.3.4. TBA and pH

The results showed that TBA values on smoked fish vary during storage. They were large ranging from 109,685 to 15,481 at the end of storage. During storage, TBA values were significantly decreased. Generally, pH value on smoked fish increased during storage time. During post mortem changes, pH is more or less constant or slightly increased due to the formation of basic compounds (Huss, 1995).

4. Conclusion

The two liquid smoke flavourings studied led to changes in the characteristic of smoked stingray. Sensory characteristic changes were similar in both corncob and coconut shells liquid smoke treatment. In contrast, chemical changes on smoked stingray were different. Although each liquid smoke has specific chemical compounds but they could be used to smoked stingray.



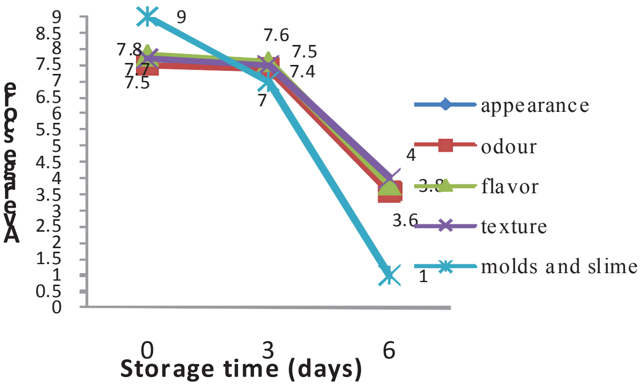


Fig. 1. (a) Average score of smoked stingray sensory with CCLS, (b) Average score of smoked stingray sensory with CCLS

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