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LIQUID SMOKE PERFORMANCE OF LAMTORO WOOD AND CORN COB

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ABSTRACT

Smoking of fish by using liquid smoke is already needed to be implemented in Indonesia, as it could produce a high quality and safe smoked fish products. Various wood and agricultural wastes are possible to be used as raw material of liquid smoke. The aimed of this research was to explore the liquid smoke performance of Lamtoro wood as a representative of hard wood and liquid smoke of Corn cob as representative of agricultural wastes which contain of anti oxidative and bactericidal component processed by dry distillation method with the temperature reach to ± 400ºC. The results showed that chemical composition of the two liquid smoke have their own specification. Phenolic compounds of each liquid smoke were: 481,2 ppm (Lamtoro); 335 ppm (Corn cob) . pH value: 3 (Lamtoro) ; 2,9 (Corn cob). Both of liquid smoke found not containing of carsinogenic Benz (a) Pyrene, but Lamtoro was contain Benz (ghi) Peryle in a small amount: 1,869 ppm.

Key word: Liquid Smoke, Lamtoro Wood , Corn Cob

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INTRODUCTION

The use of liquid smoke as an alternative method of smoking fish which is environmentally safe is already needed to be implemented in Indonesia since other country such as: U,K; Canada, Japan, etc have used this product for more than 50 years. Indonesia has a plenty of natural resources of wood and agricultural wastes i.e: teakwood, bangkirai, lamtoro, coconut cell, paddy caff , corn cob, etc that are potential to be used as raw material of liquid smoke. Swastawati (2005) noted that traditional smoked fish shows the possibility of the carcinogenic compound present in the product causes by improper smoking process. Smoking of fish also gave an effect to environment. Wood smoke contains two groups of chemical compounds such as vapours and "droplet" (Swastawati, 2003). Small group of smoke would contain of thousands of chemical compound which tend to have similar structure both in vapours and droplets but different in the quantity depending on the hardness of the wood. (Burges, 1995). Liquid smoke is inhibited by *Listeria monocytogenes* pathogenic bacteria (Milly and Toledo, 2004).

This research was aimed to produce and to analyse the quality and chemical composition of liquid smoke made by using lamtoro wood as a representative of

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hardwood and corn cob as representative of agricultural waste.

It is expected that the implementation of liquid smoke in Indonesia will soon be developed in order to give more alternative menu to consumers.

MATERIALS AND METHODS

Production of liquid smoke

About 100 kg of Lamtoro wood **(Fig1)** and Corn cob **(Fig 2)** were used as raw materials of liquid smoke processed by distillation system. The machine **(Fig 3)** is set into the temperature of ± 400ºC

Fig 1 : Lamtoro Wood

Fig 2: Corn Cob.

Fig 3. Condensation Machine

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Laboratory analysis

In order to evaluate the quality of liquid smoke some chemical analysis i.e: hydrocarbon component, phenolic, formaldehide, pH and Benz (α) pyrene (BP) carcinogenic were investigated. Chemical analysis was done by using Spectrofotometry and Gas Chromatography method, Swastawati, 2005).

Analysis of Data

Data analysis was done by using descriptive explorative method. All data are tabulated in the form of table or figure. (Djarwanto and Pangestu, 1993). The characteristic of descriptive means that information taken from the result of research was aimed to give the illustration status of phenomena (Arikunto, 1996).

RESULTS AND DISCUSSION

Production of liquid smoke.

Production of liquid smoke of Lamtoro Wood **(Fig 4)** and Corn Cob **(Fig 5)** resulted from this research are presented in **table: 1**.

Fig: 4. Lamtoro Wood Liquid Smoke

Fig: 5. Corn Cob Liqid Smoke

Table 1. Production of Liquid Smoke of Lamtoro Wood and Corn

	Raw Material	
Parameter	**Lamtoro Wood**	**Corn Cob**
Weight of Raw Material (kg)	2,5	2,5
Volume of Liquid Smoke (L)	1,31	1,5
Persentage of Liquid Smoke (%)	52,55	60
Charcoal and Ash (%)	47,45	40

Source: Research result: 2006

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Table 1 shows that Corn Cob gave higher persentage of liquid smoke compared to Lamtoro Wood. Tranggono *et al*., (1996) found that coconut shell produced 52,85% of liquid smoke, 31,75% charcoal and ash and evaporated gas 15,4%. These evaporated gas were indicated as CO_2, CO, CH_4 and hidrocarbons.

Hardwood such as Lamtoro Wood and agricultural waste like corn cob can be used as raw materials of liquid smoke. This raised the possibility that many kinds of wood materials are possible to be implemented in Indonesia.

Warisno (1998) noted that dried corn cob is some times used as firewood. According to Suharto (1991) corn cob is one of the smoke sources that containing celulose and lignin.

Kanoni (1991) explained that liquid smoke also contain of organic acids i.e: acetic acid, and formic acid as antioxidant agent together with phenolic compounds. Acids containing in liquid smoke give an influences to foodstuff in terms of flavour, pH, and shelf life.

Phenolic compound is also responsible to give preservation, aromatic and antioxidant effect to the product (Gilbert and Knowles, 1992). Agricultural waste containing phenolic compound in various structure i.e: 2-methyl phenol, 2-methoxy-phenol, 2,4-dimethoxyphenol, guaiacol which have capability to give a specific smoke aromas to the product. According to Buckle et.al (1985), these antioxidant component will attached to the fish body and therefore rancidity process can be avoided.

Phenol Analysis

Phenolic compounds that found in liquid smoke are specific between one another, depending on the raw material used. The result of phenolic analysis can be seen in **table:2**.

Table 2. Phenol Content of Lamtoro Wood and Corn Cob Liquid Smoke.

Liquid Smoke	Phenol Content (ppm)
Corn Cob	335
Lamtoro Wood	481,2
Giulini Chemie	160*

Source: Research report (2006)

* Ref. Giulini Chemie, UK. (1993)

Table 2. shows that Lamtoro Wood liquid smoke containing higher phenol content comparing to Corn Cob liquid smoke. According to Kanoni (1991), hard wood tend to contain high cellulose, hemicellulose and lignin. Phenol in smoke is one of thermal degraded results of lignin in wood (Girrard, 1992). Moreover, Kanoni (1991) Mentioned that the higher the phenol content the longer shelf life of the product. Glossy appearance, and specific taste are also affected by phenol in smoke product. In other word, phenol can be used as a quality indeks of smoking fish. But, too high phenol

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content is possible to cause carsinocenic effect.

High content of phenol is possible to produce of Polyciclic Aromatic Hydrocarbon (PAH) carcinogen. Therefore, too high phenol content is dangerous to human health. The limited phenol content of smoke food is 317 mg/kg (Occupational Safety and Health Administration U.S. Department of Labor, 2005). Phenolic compound in liquid smoke is also affecting the colour of product (Darmadji, 2002).

Setiadji (2005) noted that the quality and quantity of these chemical compound in smoke are depending on the kind of wood, age of the threes, and the condition of land where the threes growth. Wibowo (2002) mentioned that phenol give preservative effect to the product because if its characteristics and capability to kill bacteria (bactericidal effect), fungi (fungicidal effect) and its antioxidative properties to prevent rancidity. The brown gold colour of smoked fish is caused by the reaction of phenol with oxygen from the air. Phenolic fraction responsible to the specific odour and taste are guaiakol, 4-metil guaiakol, 2,6-dimetoksi phenol. Guaiakol give smoke flavour and syringol is responsible to odour. Antioxidative action and bactericidal effect of phenolic compound give an impart to shelf-life of smoked fish until 4 days. (Swastawati, 2005).

pH Value

Low value of liquid smoke is caused by organic acid present as a result of condensation process of smoke. Organic acids also give an effect to preserve fish and meat product. The result of pH value is presented in **table: 3.**

Table 3. pH Value of liquid smoke

Liquid Smoke	pH Value
Lamtoro Wood	3,0
Corn Cob	2,9
Giulini Chemie	2,3

Source: Research report (2006)

*** Ref : Giulini Chemie. (2003)**

The result shows that lamtoro wood liquid smoke tend to has higher pH than corn cob liquid smoke. pH value are effecting by some factors i.e.: kind of wood and its hardness, condensation process, and the temperature setting. The present of organic acids gave an effect of acidity to the liquid smoke product. Swastawati (2002) noted that delicious smoky taste is caused by reaction of acids, phenols and other additional substances. Liquid smoke inhibiting the

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growth of bacteria until pH 4. The pH value of 6 give lower effect in killing bacteria.

Analysis of Benz (a) pyrene

Polyciclic Aromatic Hydrocarbon (PAH) is undesireable chemical compound that is present in smoke. Some PAH showed the carcinogenic characteristic in the smoked product. One of chemical element that known as an agent of carcinogenic indicator is Benz (α) pyrene (3,4-Benzpirena). According to De man (1989) wood smoke is consist of many kind of PAH compound such as: Fenantrena, Antrasena, Pirena, Fluorantrena, 1,2-Benzanthrasena, Krisena, 3,4-Benz (α) pirena and 1,2-Benzpirena. Not all of PAH are carcinogenic, but Benz (α) pyrene (BP) is known as carcinogenic indicator.

Result of this study of PAH analysis is presented in **Table: 4**.

Table 4. PAH Compound Found in Lamtoro Wood and Corn Cob Liquid Smoke (ppm)

PAH Compound	Liquid Smoke	
	Corn Cob	Lamtoro Wood
Me-Naphtalene	ND	ND
Acenaphthylene	ND	ND
Acenaphthene	ND	ND
Fluorence	ND	ND
Phenanthene	ND	ND
Anthracene	ND	ND
Fluoranthene	ND	ND
Pyrene	ND	ND
Chrysene	ND	1.174
Benz(k)Fluoranthene	ND	ND
Benz(a)Pyrene	ND	ND
Indeno(123,cd)Pyrene	ND	ND
Dibenz(ah)Anthacene	ND	ND
Benz(ghi)Peryle	ND	1.869

Source: Research report (2006)
Note: ND = not detectable

Table 4. shows that PAH, particularly Benz (α) pyrene was not detected in both liquid smoke used in this study. But, care must be put in some cases because in a certain condition PAH could be naturally present in particular fish depending on its fishing ground. 3,4 Benz (a) Pyrene is mostly found in tar, the amount of it is

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depend on the density of smoke, the quality of smoke sources and the method of condensation used. (Purnomo, 2002).

CONCLUSION

It can be concluded that lamtoro wood and corn cob have their own chemical characteristic specifically. Both of them consisted quite high phenolic compounds, therofore it must be implemented in the small concentration. Both liquid smoke were found free of Benzo (α) pyrene carcinogenic compound, means that they are possible to be use in the smoking process of fish. Beside, they also give to impart glossy golden brown colour, delicious taste, specific odour and special aromas to the product.

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