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## The Effect of Heating Process using Electric and Gas Ovens on Chemical and Physical Properties of Cooked Smoked-Meat

Yusnaini<sup>a\*</sup>, Soeparno<sup>b</sup>, Edi Suryanto<sup>b</sup>, and Ria Armunanto<sup>c</sup>

<sup>a</sup>Departement of Animal Husbandry, Faculty of Agriculture, Universitas Khairun, Ternate, Indonesia

<sup>b</sup>Department of Animal Production Technology, Faculty of Animal Husbandry, Universitas Gadjah Mada, Yogyakarta, Indonesia

<sup>c</sup>Departement of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Gadjah Mada, Yogyakarta, Indonesia

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### Abstract

Study of potential of kenari (*Canarium indicum* L.) shell as a raw material in liquid smoke production for meat flavor developer has been done. To achieve this study, heating method using electric and gas ovens on the properties of the cooked smoke-meat have been carried out. The characterization of chemical properties (water content, protein content, fat content, TBA and the number of peroxide, physical properties (cooking loss, WHC, tenderness, color) cooked smoke-meat were analyzed using the Independent-Sample T Test. The results showed that protein and water contents as well as physical properties of electric oven- and gas oven-heated-cooked smoked meats were relatively the same. Fat content of electric oven-heated-cooked smoked meat was higher than that of oven gas-heated-cooked smoked meat. The TBA and peroxide values of electric oven-heated-cooked smoked meat were lower than gas oven-heated-cooked smoked meat.

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**Keywords:** kenari shell, liquid smoke, electric oven, gas oven, cooked smoked-meat.

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### INTRODUCTION

The use of liquid smoke was developed in the late of 1980s in order to replace the traditional smoking process [1]. The increasing of the number of researches in the production of liquid smoke from various woods [2], coconut shell [2], *Vitis venivera* L. [3], agricultural waste [4], *Fagus sylvatica* L. [5], *Salvia lavandulifolia* [6], spice

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\* Corresponding author.

E-mail address: [yusnaini\\_unkhair@yahoo.co.id](mailto:yusnaini_unkhair@yahoo.co.id)

solid wastes [7], rubber wood [8], cassava wood [9], and oak [10]. The liquid smoke could be applied as antibacterial [11; 4; 12; 13], antioxidant [11; 4; 14; 15], preservative [16]. The liquid smoke is also used to organoleptic or sensory [7; 9; 17], texture [18; 19], physicochemical [20; 19], chemical and microbiological [17], benzo(a)piren content [9; 21].

The utilization of liquid smoke on meat to replace the traditional smoking leads the volatile compounds to be deposited on the surface. The meat does not obtain enough heat, thus it is still raw. Based on those points of view, the further treatments, such as heating, should be conducted so the smoked meat could be readily eaten.

Low temperature and long time heating at  $\leq 110^{\circ}\text{C}$  could be the alternative process to heat the meat [22]. Temperature of  $80^{\circ}\text{C}$  is the ideal and popular one as the meat would have appropriate tenderness on the quality assay [23].

Heating process using electrical and gas ovens could be done by low-moderate society. Heating using both electric and gas ovens at the same temperature was expected to produce the same characteristics of cooked meat. The question would be whether the heating time of raw meat using an electric oven and gas oven would be the same. The heat source of electric oven was rod element equipped on the top and bottom sides of the oven. The element will smolder if the oven is turned on. The employed element is only the bottom one. The heat propagation on the electric oven is conduction (heat transfer from heat source to tray) and convection (heat transfer from the surface to the inside of meat). The heat source of gas oven is gas fuel. The fire from gas stove is put at the bottom of oven. The heat propagation is conduction (heat transfer from the oven chamber to tray) and convection (heat transfer from the surface to the inside of meat).

The heating at the same oven and internal temperatures of could probably give the pH, water, protein and fat contents of cooked smoked meat since the employed energy is same. The energy could only evaporate air and not destroy the molecules of meat. The fat content, peroxide number and TBA value are predicted to be different if the heating time is different. Fat could melt at range of  $37\text{-}40^{\circ}\text{C}$ . On the other word, the quantity of melted fat would increase as the increase of the heating time. Concentration of  $\text{Fe}^{2+}$  sharply increases during the process and leads the fat oxidation. Therefore, both peroxide and TBA values would increase.

A physical property of cooked smoked meat that is prepared by using electric oven is predicted to be the same as that using gas oven. The physical properties of meat are closely related to the chemical properties, particularly water and protein contents of meat.

## **MATERIAL AND METHODS**

### **Preparation of Liquid Smoke**

Production of liquid smoke was done by pyrolysis. Pyrolysis furnace was equipped with a 1500 watt electric heater encircling reactor with a diameter of 20 cm and height of 40 cm which could be charged with as much as 4 kg of materials. Reactor cover was connected by pipeline to the cooling tubes used to condense the fumes

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