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VARIATIONS IN TEMPERATURE AND FERMENTATION TIME TO PRODUCE QUALITY BLACK GARLIC

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ABSTRACT

Black garlic is a fermented product of garlic which is heated at a temperature of 65-80 C with a humidity of 70-80% from room temperature for one month. Black garlic has a black color, is light because the water content is reduced and has a less pungent aroma and taste like garlic and has stronger antioxidant activity than garlic so it can be used to prevent diabetes complications. This study aims to determine the temperature and duration of garlic fermentation in order to produce high quality black garlic. The research was carried out at the agricultural technology laboratory of the UISU Faculty of Agriculture, Johor Building, Medan. The study used a factorial completely randomized design with three replications with temperature and duration of fermentation as treatment. The results showed that a temperature of 60-75°C and a fermentation time of 7-13 days were still able to produce the best quality black garlic.

KEYWORDS: Garlic, Black Garlic, Temperature, Fermentation.

INTRODUCTION

Garlic (*Allium sativum*) has long been used as a flavoring agent and has the potential to prevent and cure various diseases.[1] Many recent studies have shown the pharmacological effects of garlic, such as antibacterial, antifungal, hypolipidemic, hypoglycemic, antithrombotic, antioxidant and anticancer.[2]

Garlic bulbs contain the active substance allicin which has bacteriostatic and bactericidal effects. Types of garlic that are commonly found in Indonesia are green Lumbu, Yellow Lumbu, Cirebon, Tawangmangu, Iliocos species from the Philippines and Thailand types. Green Lumbu is a superior variety that has high production potential and is recommended to be planted.[3] Garlic can be processed by fermentation and produce black garlic or black garlic. Black garlic is a fermented product of garlic which is heated at a temperature of 65-80 ºC with a humidity of 70-80% from room temperature for one month.[4]

Black garlic has a black color, is light because the water content is reduced and has a less pungent aroma and taste like garlic. In black garlic, S-allylcysteine helps the absorption of allicin so that the metabolism of protection against bacterial infections becomes easier.[1] The results of Lee's study[5] stated that the TEAC 2 antioxidant values of garlic and black garlic were 13.3 and 59.2 mol/g wet, respectively. Black garlic has stronger antioxidant activity than garlic so it can be used to prevent diabetes complications. Black garlic has stronger antibacterial properties, as well as 2 times higher antioxidants than ordinary garlic because it contains S-allycysteine.[6]

The results of Bae's research[7], the longer the fermentation time of black garlic, the higher the content of S-allycysteine (SAC). With the presence of higher antibacterial compounds than garlic, it is expected to be more effective in overcoming pathogenic prokaryotes that cause disease. Pathogenic prokaryotes are responsible for about half of all human diseases. Black garlic or black garlic, is now a healthy food ingredient that is on the rise. Black garlic can be easily found in supermarkets. However, what are the main benefits of

this black garlic. Black garlic is an ancient food ingredient. It was first made in Korea about 4,000 years ago, and is now back in favor with both healthy lifestyle practitioners and nutritionists. Scientists have also discovered many health benefits not found in ordinary garlic. Black garlic is processed through an aging/fermentation process that lasts about 3 weeks. Processed in moist and hot conditions to form a caramel on the onion meat, including forming a stronger flavor. Sugars and amino acids produce melanoidin, which turns the garlic flesh black.

There are many processed products derived from garlic in several countries such as China and South Korea, one of which is black garlic. Black garlic is garlic that is warmed to a certain temperature and humidity so that it becomes black, soft and slightly sour. Many studies have proven that garlic contains antibacterial substances, namely alliin (S-allyl-cysteine sulphoxide) which is synthesized from the amino acid cysteine.[8]

Black garlic is not a new type of onion variety. Black garlic is ordinary garlic that undergoes a fermentation process by utilizing high temperatures to produce black garlic. This black garlic is made through the storage process of whole garlic (accompanied by the skin) in a place or room that has set the humidity level and the temperature is between 60-70 °C. The way of fermentation is done by putting the garlic in a stainless bowl and covering it with aluminum foil, then this bowl is placed in the oven and baked using a temperature of 60-70°C.

MATERIALS AND METHODS

The research was carried out at the agricultural technology laboratory of the UISU Faculty of Agriculture, Johor Building, Medan. The materials used are garlic and aluminum foil. The tools used are Scales, Erlenmeyer, Filter, pH meter, Pan, Stove, Blender, Beaker glass, Stirrer, Oven blower, Porcelain Cup and Muffle. The chemicals used are Sodium benzoate (C_6H_5COONa), Iodine 0.01 N, NaOH 0.1 N, 1% starch solution and Aquades.

The study used a factorial completely randomized design with three replications with two treatments. The first treatment was the Fermentation Temperature (S), which consisted of four levels, namely: 65^0C (S1), 70^0C (S2), 75^0C (S3), 80^0C (S4). The second treatment was Fermentation Time (L) which consisted of four levels, namely: 7 days (L1), 9 days (L2), 11 days (L3), 13 days (L4).

The research was carried out by selecting large-sized garlic as much as 200 g, not rotten, and still intact, not broken. Unpeeled garlic is left in a dry and not moist condition and wrapped in a wrapper, and put into a blower oven. Then fermented with the appropriate temperature treatment (65ºC, 70ºC, 75ºC, and 80ºC) and fermentation time according to treatment (7, 9, 11, 13 days). Furthermore, the analysis of vitamin C content, ash content, water content, organoleptic color and taste was carried out.

The content of vitamin C was determined by the Jacobs method. 10 mL of material is taken and put into a 100 mL erlenmeyer, then added with distilled water until the mark is 100 mL and stirred until dissolved then 10 mL is taken then put into the erlenmeyer and dripped 2-3 drops of 1% starch solution into it, then titrated with iodine solution 0.01 N until a blue color is formed. Vitamin C levels are determined by the equation:

$$Vit.C\ content\ (mg/100\ g\ ingredients) = \frac{mL\ Iod\ 0.01\ N\ x\ 0.88\ x\ Fp\ x\ 100}{Sample\ weight\ (g)}$$

Determination of ash content using the ashing method. The material is weighed as much as 5 g in a dry porcelain dish and the weight is known, then ignited in a muffle at 600 0C until white ash is obtained.

$$Ash\ Level\ (\%) = \frac{Ash\ Weight}{Sample\ weight\ (g)} x\ 100\%$$

Water content was determined by oven drying method. The material was weighed as much as 5 g and then dried in an oven at 105 °C for 4 hours. After that, it was cooled in a desiccator for 15 minutes and then weighed. The weighed sample was reheated in the oven for 1 hour and cooled in a desiccator and weighed again. This treatment was repeated until a constant weight was reached. The water content can be calculated by the equation:

$$Water\ Content\ (\%) = \frac{Initial\ Weight - Final\ Weight}{Final\ weight\ (g)} x\ 100\%$$

The taste organoleptic test was determined by the panelist test method for overall acceptance, the value given to the preference test can be seen in Table 1 below.

Table 1: Hedonic and Numerical Scales of Taste Organoleptic Values.

Hedonic Scales	Numeric Scales
Prefer	4
Like	3
Do not like it much	2
Do not like	1

Color assessment is based on a hedonic scale and a numerical scale, namely by giving an assessment of the sample and given to 10 panelists.

Table 2: Hedonic and Numerical Scales Color Organoleptic Values.

Hedonic Scales	Numeric Scales
Dark Brown	4
Brown	3
White Brownish white	2
White	1

RESULTS AND DISCUSSION

The results showed that the effect of temperature and duration of fermentation had no significant effect on all observed variables (Tables 3 and 4). Likewise, the interaction treatment between the two treatments also had an insignificant effect on all observed variables.

Table 3 shows that the water content and vitamin C content decreased with increasing fermentation temperature. The highest water content and vitamin C content were found at a temperature of 60°C. On the other hand, the ash content and organoleptic color increased with increasing fermentation temperature. The highest ash content and organoleptic color was found at a temperature treatment of 75°C. Meanwhile, the organoleptic taste increased only up to a temperature treatment of 70°C, and decreased again at a temperature treatment of 75°C. The highest organoleptic taste was found at a temperature treatment of 70°C.

Table 3: Water content, ash content, Vitamin C content, and organoleptic taste and color of black garlic with fermentation temperature treatment.

Temperature (S)	Water Content (%)	Ash Level (%)	Vit. C Content (mg/100g)	Color	Taste
S_1 = 60 ^{0}C	51.395	0.731	19.810	3.214	3.138
S_2 = 65 ^{0}C	46.890	0.746	18.328	3.225	3.250
S_3 = 70 ^{0}C	43.745	0.758	17.731	3.238	3.636
S_4 = 75 ^{0}C	41.690	0.772	17.456	3.240	3.375

Tabel 4: Water content, ash content, Vitamin C content, and organoleptic taste and color of black garlic with fermentation time treatment.

Fermentation Time (L)	Water Content (%)	Ash Level (%)	Vit. C Content (mg/100g)	Color	Taste
F_1 = 7 hari	50.363	0.789	18.711	2.920	3.025
F_2 = 9 hari	47.376	0.771	18.526	3.144	3.308
F_3 = 11 hari	44.390	0.740	18.286	3.325	3.463
F_4 = 13 hari	41.591	0.706	18.106	3.528	3.625

Tabel 4 menunjukkan bahwa semakin lama fermentasi menyebabkan terjadinya penurunan kadar air, kadar abu, dan kadar vitamin C serta meningkatkan organoleptik warna dan rasa bawang putih hitam.

CONCLUSION

The results showed that a temperature of 60-75°C and a fermentation time of 7-13 days were still able to produce the best quality black garlic.

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