**PENGARUH JENIS WADAH DAN WAKTU FERMENTASI TERHADAP KUALITAS BIJI KAKAO DI TIDORE KEPULAUAN**

**THE EFFECTS OF CONTAINER TYPE DAN FERMENTATION PERIOD TOWARDS COCOA BEENS QUALITY IN TIDORE ISLAND**

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**ABSTRACT**

***The purpose of this study was to determine the effect of wooden box containers on the quality of fermented cocoa beans. The experimental design used was Completely Randomized Design (CRD) with one factor, namely the length of fermentation consisting of each treatment repeated 3 times so that 9 experiments were obtained. The results obtained are analyzed for variance and if there is a significant difference between treatments, the Dancen test will be carried out (Gaspersz, 1998). By the results of the treatment and discussion, it can be concluded that after fermenting cocoa beans using wooden boxes, the results obtained were an increase in the fermentation index of dry cocoa beans on the 3rd to 5th days (0.243, 1.147 and 2.027). This number indicates a change in color from purple to brown. Furthermore, the yield of dry cocoa beans, the content of moldy beans, and the skin content were at quality levels B and C and the water content and fat content still met the requirements of SNI-2323-2008. Polyphenols as antioxidants are in the range of 0.06 - 0.08. Based on this research it is also recommended that the fermentation process of beans use wooden boxes because it meets the requirements of the Indonesian National Standard for Cocoa Quality Number 2323-2008.***

***Key world: cocoa beans, container fermentation, chemical and physical properties***

**INTRODUCTION**

**One of the processes that play an important role in the quality of the cocoa beans produced is the fermentation process and the drying process (Wahyudi et al., 2008). In the cocoa bean fermentation process, the factors that can affect the quality of cocoa beans are the length or time of fermentation. From these several factors, the fermentation capacity which refers to the dimensions of the fermentation container and the duration of fermentation are very important factors to produce good quality cocoa (Afoakwa et al, 2011). The results of research conducted by Arinata et al., (2020) showed that the quality of lindak cocoa beans fermented for 3 days produced the best dry cocoa beans using wooden boxes. Research conducted by Aryani et al (2018) showed that fermenting cocoa beans in a capacity of 7.5 kg using wooden boxes gave a better response than other types of fermentation containers on the quality of fermented dry cocoa beans.**

**Cocoa is one of the plantation commodities that plays an important role in Indonesia today, one of which is as a source of state foreign exchange. Cocoa bean production in Indonesia in the January-March 2018 period totaled 6,125 tons of cocoa production. In the same period in 2019, Indonesia was only able to produce cocoa reaching 3,729 tons, a decrease of 61% compared to 2018. This condition is followed by the quality to be produced, where the quality of dry cocoa beans produced is still relatively low and varied, including beans that are not dry, non-uniform grain size, and unfermented beans. (Wahyudi et al., 2008)**

**MATERIALS AND METHODS**

**This research was conducted in the laboratory of the Agricultural Product Technology study program, Faculty of Agriculture, Khairun University, Ternate from June 5 to September 13, 2022 which consisted of preliminary treatment which included preparation of laboratory materials and the fermentation process. Furthermore, the results of the analysis of the cocoa bean fermentation were analyzed in the laboratory of the Faculty of Animal Husbandry, Hasanudin University Makassar. The tools used in the manufacture of fermented cocoa beans are knives and burlap sacks. The ingredients used in the manufacture of fermented cocoa beans include completely ripe or ripe cocoa pods, then the cocoa beans are taken and stored in sacks to remove the pulp or mucus contained in the cocoa beans. The experimental design used was Completely Randomized Design (CRD) with one factor, namely the length of fermentation consisting of each treatment repeated 3 times so that 9 experiments were obtained. The results obtained are analyzed for variance and if there is a significant difference between treatments, the Dancen test will be carried out (Gaspers, 1991). The parameters analysing were consisted of wet Cocoa Bean Fermentation Index, Yield of Dried Cocoa Beans, skin cocoa beans and defective seed levels, Water content, Fat and Polyphenol Contents**

**RESULTS AND DISCUSSION**

**A. Degree of Fermentation Index**

**The degree of fermentation is an index that compares the absorbance at a wave length of 460 nm and a wavelength of 540 nm. If it is a good fermentation, the fermentation of the resulting index is close to 1. Cocoa beans compare the absorbance at a wavelength of 460 nm and a wavelength of 540 nm. If it is a good fermentation, the fermentation of the resulting index is close to 1. The dry fermented cocoa beans in the sun and fresh cocoa beans are presented in the figure 1 below.**

**Fig 1. The results of the analysis of the box fermentation index**

**The results of the fermentation index analysis are shown in Figure 1 above. The figures obtained indicate that until the end of the fermentation index of dry fermented beans for drying is not met, this is presumably because the fermentation temperature is not reached. The fermentation temperature is not reached because the microbes that help fermentation are in less quantities. Determination of the degree of fermentation is also determined physically, namely by observing the color of the bean chips by splitting the cocoa beans crosswise so that the surface color of the split beans can be seen clearly. The color and texture in the cocoa bean, which was originally purple and solid, gradually turns brown and has a cavity in it (Rasadi, 2015).**

**B. Yield of Cocoa Beans**

**Yield of cocoa beans is the ratio between the weight of dry cocoa beans fermented with wet cocoa beans before fermentation. The results obtained are as shown in Figure 2 below.**

**Fig. 2. The result of dried cacao beans yield**

**The graph above shows that the yield of cocoa beans increased significantly on the 4th and 5th days of fermentation. Where on the 3rd day it was in the range of 119%, but on the 4th day there was an increase of more than 10% and on the 5th it reached 20% compared to the results obtained on the 3rd day of fermentation. This increase indicates that there is a significant increase in the quality of fermented cocoa beans.**

**C. Cocoa Seed Skin Level**

**Skin content is a waste from cocoa where a high skin content causes cocoa to be less profitable in terms of economy and cocoa consumers, so consumers want the lowest skin content, but strong enough to protect the beans from unfavorable environmental conditions, pests and fungi. The lowest skin content, which is around 11%, is considered a fairly good standard for skin content because the higher the husk content, the less yield that can be consumed, thus lowering the price of cocoa beans.**

**From the research that has been done, it shows that there are differences in each given fermentation treatment as presented in Figure 3 as follows:**

**Fig 3. The results of the analysis of the husk content**

**The graph above shows a decrease in skin levels with different durations. The results of the analysis of skin content on the 3rd day of fermentation amounted to 10.17% and decreased constantly on the 4th and 5th day of fermentation. These results indicate that the longer the fermentation process, the cocoa bean husk content will decrease.**

**D. Slaty Seed Content**

**The fermentation process that is too short will produce unfermented beans or the so-called slaty (non-fermented) beans with a solid texture and unattractive color. Yusianto et al, (1995) stated that the optimal fermentation time of seeds is about 4-5 days which will produce a brown color in the seeds. The results of the cut test of dry cocoa beans analyzed are as shown in the following figure 4 below:**

**Fig 4. The results of the analysis slaty seeds content**

**The results of the slat seed test shown in the graph above show that on the 3rd day of fermentation there is a figure of 3.13%. Furthermore, there was a decrease as the fermentation time progressed. Where on the 4th day it happened around 1.05% and on the 5th day the fermentation decreased drastically by 0.47%.**

**E. Moldy Seeds**

**Mold content is moldy seeds in the number of seeds per 100 grams sampled from each treatment, fungal content is influenced by fermentation time and storage conditions used, such as humidity and temperature in the storage box. In this study, observations were made of moldy seeds on the inside of the beans by splitting the cocoa beans transversely so that the surface of the split beans could be seen clearly. The results of the test for the levels of dry cocoa mold that were analyzed are as shown in Figure 5 below:**

**Fig 5. Analysis of moldy seed content**

**The test results showed a decrease in moldy seeds as shown in graph 5 above. From the figure, it can be seen that the longer the fermentation time the less the number of moldy seeds. This provides information that the amount of water content in the beans is decreasing so that the fungus cannot grow on cocoa beans with low water content.**

**F. Water content**

**Moisture content is one of the important factors in determining the quality of cocoa beans because it is related to the shelf life of cocoa beans. Cocoa beans that have a high moisture content will be easily attacked by insects and fungi. According to SNI 2323-2008, the standard moisture content in cocoa beans should not exceed 7.5%. This is because if the water content exceeds the standard, not only the yield but also the risk of being attacked by bacteria and fungi, but if the water content is less than 5%, then the seed coat will be easily broken or brittle (Wahyudi et al, 2008). The measurement results in the moisture content of cocoa beans are presented in Figure 6 below:**

**Fig 6. Graph of the average value of water content**

**The results of determining the moisture content of dried cocoa beans showed the highest percentage of water content in the fermentation treatment on day 3 with a water content of 7.8% where this result was due to the presence of a layer of pulp or placenta that was still attached to the dried cocoa beans which could not be decomposed by microbes. due to the short fermentation process. While the perfect fermentation is shown on the fourth day of fermentation with a value of 7.4% and the fifth day of 6.6% fermentation so that it can be accepted because it does not exceed the standard of SNI 2323-2008.**

**G. Fat content**

**Fat content is generally expressed as a percentage of the dry weight of the seed chips. Cocoa butter is a mixture of triglycerides, which are glycerol compounds and three fatty acids. More than 70% of the constituent glycerides consist of three monounsaturated compounds, namely oleodipalmitin, oleodistearin and oleopalmistearin. In cocoa fat there is also a small amount of unsaturated triglycerides (Wahyudi et al, 2008).**

**Determination of fat content by solvent, in addition to fat also includes phospholipids, sterols, free fatty acids, carotenoids and other pigments. Therefore the results of the analysis are called crude fat. The amount of fat content of dry cocoa beans from each treatment used is as shown in Figure 7 below:**

**Fig 7. The results of the average fat content**

**In Figure 7 the results of the determination of fat content show that the longer the fermentation process, the fat content of cocoa beans increases as seen on the fourth day of fermentation with a value of 7.90 and the fifth day of fermentation 8.46.**

**The results of analysis of variance showed that fermentation on day 3,4 to day 5, had a non-surgical effect on the fat content of fermented cocoa beans. This increase in fat content is caused by the water content which tends to decrease during the fermentation process which affects the resulting fat yield (Jumriah, 2012). In addition, according to Yusianto et al (1997), the fat content of unfermented cocoa beans is 0.07-5.69% lower than that of fermented cocoa beans depending on the fermentation time.**

**H.Polyphenol**

**Polyphenols are natural compounds found in plants, one of which is cocoa. This compound has the ability as an antioxidant, anti-aging (anti-aging), anti-inflammatory and anti-diabetic( Paembong 2012). While (Jinap et al, 2013) state that fermented cocoa beans contain various polyphenolic compounds, about 60% of the total polyphenols in the form of flavanol monomers (epicatechins and catechins) and procyanidin oligomers (dimers and decamers) with varying concentrations.**

**The components of this compound have strong antioxidant activity with physiological properties, namely inhibiting the activity of -amylase and -glucosidase (Nielsen, D.S. 2006, Camu et al, 2013). In this study, the levels of polyphenols contained in the seeds were observed. The results of the dry cocoa polyphenol content test were analyzed as shown in Figure 8 below:**

**Fig 8. Results of analysis polyphenols content**

**The graph above shows the polyphenol content at each fermentation time where the largest amount of polyphenol content was found on the 5th day of fermentation (F5). Then from the picture, it can be seen that there was a change in the amount of polyphenols on the 3rd (F3), 4th (F4) and 5th day.**

**The results of analysis of variance showed that fermentation on day 3,4 to day 5, had a very significant surgical effect on the water content of fermented cocoa beans. However, the moisture content of dry cocoa beans resulting from complete and incomplete fermentation is smaller than that without fermentation, which is less than 7.5% but not less than 5% so that it meets SNI 2323:2008 which requires a maximum moisture content of dry cocoa beans of 7, 5% (BSN, 2008).**

**CONCLUSION**

**By the results of the treatment and discussion, it can be concluded that after fermenting cocoa beans using wooden boxes, the results obtained were an increase in the fermentation index of dry cocoa beans on the 3rd to 5th days (0.243, 1.147 and 2.027). This number indicates a change in color from purple to brown. Furthermore, the yield of dry cocoa beans, the content of moldy beans, and the skin content were at quality levels B and C and the water content and fat content still met the requirements of SNI-2323-2008. Polyphenols as antioxidants are in the range of 0.06 - 0.08. Based on this research it is also recommended that the fermentation process of beans use wooden boxes because it meets the requirements of the Indonesian National Standard for Cocoa Quality Number 2323-2008.**

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