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IMPLEMENTATION OF PACKAGING TYPES ON THE PHYSICOCHEMICAL CHANGES OF CABBAGE AND BOK CHOY

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ABSTRACT

Pakcoy and Chinese cabbage can only last up to 3-4 days. One method to increase the shelf life and maintain the quality of these commodities is with proper packaging and storage techniques. In this study, the effect of the type of packaging on the shelf life and damage that occurs in pakcoy and Chinese cabbage commodities will be studied. This study used a Rancangan Acak Lengkap (RAL) with the type of packaging treatment factor. There are four types of packaging used, namely PP (Polypropylene Plastic), PE (Polyethylene Plastic), plastic wrappig and opaque paper. From the research results, it is known that packaging can maintain the quality or quality of mustard greens and pakcoy during storage. Chickpeas samples packaged with PP plastic experienced the lowest weight loss of 0.3%. Meanwhile, the unpackaged Chinese cabbage samples (control) experienced a weight loss of up to 43%. Pakcoy vegetables packaged in PE plastic packaging experienced the lowest weight loss of 9.1%. The unpackaged Chinese cabbage samples (control) experienced the highest weight loss, reaching 9.3%. This indicates that the packaging treatment was able to suppress damage and weight loss in Chinese cabbage and pakcoy.

Keywords: Chinese cabbage, packaging, *Polypropilene Plastic, Polyethylene Plastic*.

INTRODUCTION

Horticultural products, especially vegetables and fruits, are prone to postharvest damage due to their perishable nature. This damage can be caused by physiological, physical, chemical, or microbiological factors. High postharvest losses in vegetable commodities can lead to negative impacts such as yield reduction, economic loss [1][2], waste accumulation, environmental pollution, and instability of commodity prices in the market. The loss of horticultural products, both in terms of quality and quantity, ranges from 20-50% in developing countries and 5-25% in developed countries [3].

Vegetable commodities from the genus Brassica are quite popular. Cabbage or kale (Brassica oleracea L.) is the most produced vegetable in Indonesia [4]. Another vegetable that is also a member of the Brassica genus is bok choy (Brassica juncea L.), a vegetable originally from China but now very popular in Indonesia [5]. Cabbage and bok choy are perishable commodities that can quickly deteriorate, with a short shelf life of 2-4 days [6][7]. Damage can be caused by physiological, physical, chemical, or microbiological factors. The metabolism of vegetable commodities after harvesting cannot be stopped, but the rate of the process can be slowed down [6][2]. One way to slow down the respiration process of vegetable commodities is to use appropriate packaging techniques and types. Using packaging during storage is a solution to maintain product quality. With the right packaging, vegetables can be protected from various damage factors such as physiological, physical, chemical, or microbiological factors [8][9]. Packaging available in the market comes in various types and functions, so direct testing of

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samples under storage conditions that are appropriate for field conditions is needed to determine the most suitable packaging.

The storage method used for horticultural commodities is intended to maintain supply continuity by extending the freshness of the commodity, stabilizing prices, and increasing or maintaining quality. Collaboration between the use of plastic packaging and low-temperature storage has produced the best conditions for maintaining product quality [10][11]. Plastic packaging can be used in atmospheric modification that causes changes in the type and composition of air in the commodity/product environment. Respiration that occurs in commodities causes an increase in CO2 concentration and a decrease in O2 concentration. The use of plastic film as a packaging material for perishable commodities can prolong the shelf life, inhibit weight loss, improve product appearance, prevent damage during transportation, and be used as a promotional tool [12]. HDPE plastic has better ability to reduce weight loss and maintain the color of turnip vegetables during storage [8][13].

MATERIALS AND METHODS

Research Sites

This research was conducted in the Agricultural Product Technology laboratory at Borneo Tarakan University. The Pakchoi and cabbage samples were obtained from the traditional market in Tarakan City. The estimated time required for this study is around 4 months.

Procedures:

Sample Preparation:

Pakchoi and cabbage samples were obtained from the traditional market in Tarakan City, considering good physical conditions (not eaten by pests), freshness, and recently harvested. The purchased Pakchoi and cabbage were cleaned and dried.

Packaging of Pakchoi and Cabbage:

Pakchoi weighing 300 grams was packed in suitable packaging according to the treatment, labeled for easy observation. Clean and dry cabbage weighing 1 kg was packed in suitable packaging according to the treatment, labeled for easy observation. The packaged samples were then placed in plastic boxes and stored in a room.

Observation of Physical-Chemical Changes in Samples:

Physical-chemical properties observed included:

Physical damage:

Physical damage observation was conducted by determining a damage scale (from 1-5). Samples that experienced more than 50% damage (scale 4-5) were considered to have reached the end of their shelf life and were not further observed.

Weight Loss:

Weight loss was determined by weighing the samples every day, starting from the day after the samples were packed until the last day of observation. The larger the difference in weight, the greater the weight loss that occurred.

Moisture content:

Moisture content was analyzed by the oven-drying method. The sample was weighed per experimental unit, then oven-dried until the weight was constant.

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RESULT AND DISCUSSION

The shelf life of white cabbage and pak choi vegetables is greatly influenced by storage conditions. White cabbage and pak choi continue their metabolism, such as respiration and transpiration, even after being harvested. If this metabolism continues, it will cause the vegetables to deteriorate. Therefore, packaging is done to reduce the rate of deterioration. Proper packaging can reduce the rate of deterioration by reducing the amount of oxygen, thus slowing down the respiration process in white cabbage and pak choi [13] [14]. In addition to reducing the amount of oxygen, packaging can also protect vegetables from microbial contamination such as bacteria and fungi that can cause spoilage [15].

Weight Loss

Weight loss is one of the indicators that shows a decrease in vegetable quality. Weight loss observation is carried out to determine the change in weight or mass of white cabbage and pak choi vegetables during storage. From the observations, it is known that there is an increase in weight loss in all samples observed. The highest weight loss rate occurred in the control treatment, which was the white cabbage and pak choi samples that were not packaged.

Weight loss during storage occurs because the vegetables lose water during storage, which affects the weight loss during measurement. Post-harvest weight loss occurs due to physiological processes resulting from transpiration, respiration, and other reactions because pak choi vegetables contain 80%-90% water content, which can be lost due to these physiological processes. Water loss will occur more quickly in un-packaged conditions compared to packaged conditions, both at high and low temperatures.

Pak choi vegetables that are packaged with PE plastic and wrapping plastic experience the lowest weight loss rate compared to other types of packaging. Pak choi samples packaged with PE plastic experience weight loss of up to 9.1%, while samples packaged with wrapping plastic experience weight loss of up to 11.9%. The weight loss value of samples packaged using PP plastic and brown paper is quite high, but still lower than the weight loss of un-packaged samples (control). Pak choi samples packaged with PP plastic resulted in the highest weight loss value of 35%, while those packaged with brown paper experienced weight loss of 34.6%. Un-packaged pak choi experienced the highest weight loss, reaching 43% or almost half of the total wet weight of the sample (Figure 1).

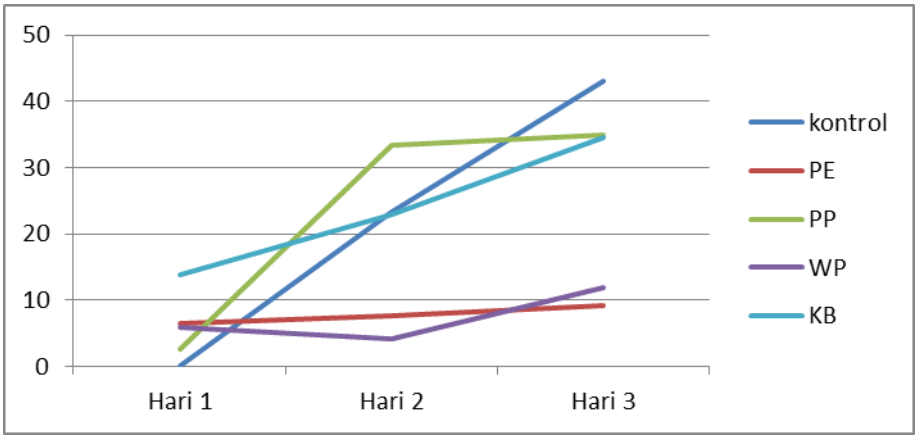

Figure 1. Weight loss rate of pakcoy during storage

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The weight loss in the samples of white cabbage during storage is caused by the loss of moisture in the cabbage. This loss of moisture can be caused by high temperature and the absence of a membrane or layer that can prevent or slow down the rate of water loss from the sample to the environment. Packaging can slow down the rate of weight loss so that the cabbage can remain fresh for a longer period of time compared to when no packaging is done.

Post-harvest weight loss occurs due to physiological processes such as respiration and other reactions, as pakcoy contains 80%-90% water by weight which can be lost due to these physiological processes. Water loss is faster at high temperatures compared to low temperatures [15]. White cabbage packed in PE plastic and PP plastic experienced the lowest weight loss rate compared to other types of packaging. The samples of white cabbage packed in PE plastic experienced weight loss of up to 0.4%, and those packed in PP plastic experienced weight loss up to 0.3%.

The weight loss rate of samples packed using wrapping plastic and brown paper was quite high, but still lower than the weight loss rate of samples without packaging (control). Samples of white cabbage packed in wrapping plastic had the highest weight loss rate of 4.3%, and those packed in brown paper had a weight loss rate of 6.5%. White cabbage that was not packaged had the highest weight loss rate, reaching 9.3% (Figure 2).

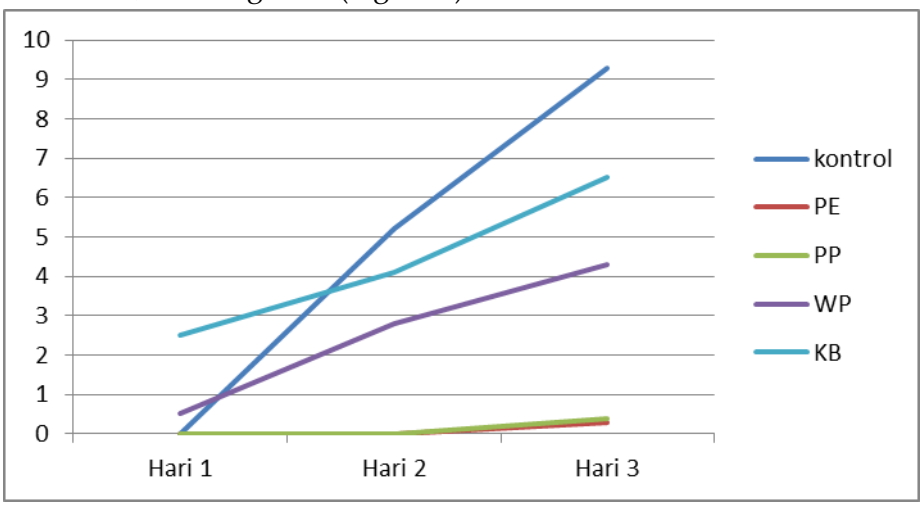

Figure 2. Weight loss rate of white cabbage during storage

Percentage of damage

The percentage of damage is measured to determine the extent of damage that occurs to white cabbage and pakcoy samples during storage. The observed damage is physical damage that includes changes in color, wilting, decay, as well as physical defects such as tearing or breaking. Based on observations made over three days, white cabbage and pakcoy can only be stored for up to three days without any damage. Storage for more than three days can still be done with wrapping plastic or brown paper, but the outermost leaf part of the sample experiences some physical damage (Figure 3).

The most common type of damage is decay in the lower stem part of the white cabbage and pakcoy samples. Decay can be caused by a high level of carbon dioxide in the packaging, which causes an increase in temperature inside the packaging. The increase in temperature results in the breakdown of sample cells, causing them to burst and decay. Packaging will have a better effect on storage when combined with low-temperature storage. However, low-temperature storage

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requires high costs and cannot be applied to traditional retailing in markets such as those commonly found in Tarakan City.

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