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Appearance of *Lactobacillus* SP starter from cabbage with the addition of pineapple extract and food vinegar

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Abstract
Cabbage contains carbohydrates, protein, vitamins and minerals. The content in cabbage can be used as a raw material for making lactic acid bacteria. One of the lactic acid bacteria that can be produced from fermented cabbage is *Lactobacillus* sp. In the manufacture of starter lactic acid bacteria required a source of sugar and nutrients that help the growth of bacteria daa starter. The raw material used is cabbage, with different treatments. The first treatment with the addition of 5% food vinegar and the second treatment with the addition of pineapple extract 1:1 (v/v). The method used is laboratory experimental which is analyzed descriptively. The results showed that the addition of 5% food vinegar and pineapple extract 1:1 (/v) in this study gave different results for the formation of starter *Lactobacillus* sp. Fermentation was carried out for 7 days at room temperature. The treatment for making *Lactobacillus* sp starter with the addition of pineapple was faster, which occurred on the second day, while the treatment with the addition of 5% food vinegar occurred on the 4th day with the results being cloudy, there were bubbles, there was sediment at the bottom of the liquid, and a white layer on upper layer.

Keywords: *Lactobacillus* sp, pineapple extract, food vinegar, fermentation, cabbage, lactic acid

Introduction

Lactobacillus is a genus of lactic acid bacteria consisting of various species. They are facultative anaerobic microorganisms that can be found in the digestive systems of humans and animals, fermentation products, soil, and water. Several *Lactobacillus* species have probiotic properties that are beneficial to human and animal health, such as maintaining a balance in the gut microbiota, improving digestion, and strengthening the immune system. *Lactobacillus* is also used in the food industry as a starter culture in food fermentation. Overall, *Lactobacillus* has an important role in human health, fermented food production, and the biotechnology industry.

Lactobacillus sp can be extracted from various food sources, such as pineapple and cubes. Pineapple can play an important role in the manufacture of starters in several fermentation methods, especially in the manufacture of vegetable starters or fruit starters. Pineapple can serve as a source of sugar and nutrients needed for the growth of bacteria in the starter. The natural sugar content in pineapple, such as fructose and glucose, provides energy for bacteria during the fermentation process. In addition, pineapple also contains proteolytic enzymes such as bromelain which can help break down proteins and increase the availability of nutrients for bacteria. The use of pineapple in the manufacture of starter can also provide unique organoleptic characteristics of fermented products. However, the role of pineapple in the manufacture of the starter may vary depending on the type of starter and the fermentation method used. It is important to refer to the specific recipe and guide related to the starter method to understand the role of pineapple in more detail in that context.

Inhibiting the growth of spoilage bacteria in fish, this can be done by storing fish at low temperatures, because basically bacteria cannot grow at 5-10o C. However, even though it has been stored at low temperatures, there are still some spoilage bacteria that can survive. Therefore the addition of lactic acid bacteria in fish is needed, in order to extend the quality and shelf life of fish.

Fermentation is a metabolic process in which chemical changes occur in the substrate/organic material due to the activity of enzymes produced by microorganisms (RD *et al*. 2009). Fermentation is a food processing business that is used to increase product shelf life and diversify processed products (Ayustaningwarno *et al*. 2015).

Fermented cabbage waste can produce probiotic bacteria to maintain the health of the digestive tract of livestock (Utama *et al*., 2018a; Hartono *et al*., 2016) [13] (Utama *et al*., 2020) [13]. Improving the microbiological quality of fermented cabbage waste can be done by adding a source of vitamins and minerals. Cabbage waste contains various vitamins (A, B, C, E) and minerals such as calcium, potassium, phosphorus, sodium and iron (Aliya *et al*., 2016) (Utama *et al*., 2020) [13]. The content of vitamins, minerals, carbohydrates, proteins and fats contained in cabbage makes it possible to utilize the cabbage waste as a raw material for making lactic acid (Pracaya, 1994) (Suprihatin, D. S. P. 2010) [11]. Lactic acid is a multipurpose chemical used as: 1) acidulant, fragrance and preservative in the food, medicine, leather and textile industries; 2) for the production of basic chemicals; 3) and for the polymerization of materials that are easily broken down poly lactic acid (PLA) (Nur Hidayat *et al*., 2006) (Suprihatin, D. S. P. 2010) [11]. The main principle of making lactic acid by the fermentation process is the breakdown of carbohydrates into their monosaccharide form and from these monosaccharides with the help of enzymes produced by *Lactobacillus* sp. is converted to lactic acid. These bacteria naturally occur on the surface of plants (vegetables) and dairy products (Buckle *et al*., 1987) (Suprihatin, D. S. P. 2010) [11]. The purpose of this study was to observe the presence of *Lactobacillus* spp. in this starter, find out how to make *Lactobacillus* spp. bacterial starter, using raw materials, namely cabbage with different fermentation process aids.

Materials and Methods

Research on making *Lactobacillus* sp starter from cabbage was carried out at the PANGANDARAN PSDKU campus in May 2023. The research method was carried out in an experimental laboratory with descriptive tests. Making *Lactobacillus* sp culture from cabbage was done with 2 treatments. The first treatment was the addition of 5% food vinegar and the second treatment was the addition of pineapple extract with a ratio of 1: 1 (v/v) which was fermented in a closed jar and stored at room temperature. The fermentation process was carried out for 7 days. The process of observing Latobacillus sp starter was carried out every day for 7 days. Observations made on the *Lactobacillus* starter included appearance, precipitate, bubbles, and aroma.

Results and Discussion

Making starter *Lactobacillus* sp. with 2 treatments, namely the first treatment of cabbage and 45 ml of food vinegar water. For the second treatment of cabbage and pineapple juice, the cabbage was inserted as high as 3 cm and added pineapple juice one times the height of the cabbage. This difference in treatment was carried out to prove the decay products of *Lactobacillus* sp. On the first day until the second day, no sign of decay was found because the odor indicator had not been detected. While on the third day to the seventh day, signs of decay had been found because they had fulfilled the odor indicator and on the seventh day they had fulfilled the sediment indicator. In order for the successful formation of *Lactobacillus* sp. it may take additional time to the starter. In the second jar, on the first day the decay was not obvious even though the sediment, bubbles and odor indicators were present. On the second day until the seventh day there has been decay because all indicators are fulfilled. However, the decay found in the second jar was not caused by *Lactobacillus* sp. but due to contamination. The results of observations of cabbage fermentation with the addition of food vinegar for 7 days are presented in Table 1. Meanwhile, the fermentation of cabbage with the addition of pineapple extract for 7 days is presented in Table 2.

Table 1: Observations of *Lactobacillus* starter in fermented cabbage with the addition of food vinegar

No	Date	precipitate	Bubble	Smell	Picture
1	Saturday 6 May 2023	there isn't any yet	there isn't any yet	there isn't any yet	
2	Minggu 7 Mei 2023	there isn't any yet	there isn't any yet	doesn't sting	
3	Monday May 8th 2023	there isn't any yet	there isn't any yet	strong scent	

4	Tuesday May 9th 2023	there isn't any yet	there isn't any yet	strong scent	
5	Wednesday May 10th 2023	there isn't any yet	there isn't any yet	strong scent	
6	Thursday May 11th 2023	there isn't any yet	there isn't any yet	strong scent	
7	Friday 12 May 2023	There is	there isn't any yet	very strong smell	

Table 2: Observations of *Lactobacillus* starter in fermented cabbage with the addition of pineapple extract

No	Date	precipitate	Bubble	Smell	Picture
1	Saturday 6 May 2023	There is a Precipitation	There's a bubble	a little smelly	
2	Minggu 7 Mei 2023	There is a Precipitation	There's a bubble	Kind of stings	
3	Monday May 8th 2023	There is a Precipitation	There's a bubble	start to sting	
4	Tuesday May 9th 2023	There is a Precipitation	There's a bubble	started to sting like tape	

5	Wednesday May 10th 2023	There is a Precipitation	More bubbles	start to sting	
6	Thursday May 11th 2023	There is a Precipitation	more bubbles	strong scent	
7	Friday 12 May 2023	There is a Precipitation	Lots of bubbles	Very pungent	

Observation of the manufacture of starter *Lactobacillus* sp. This was carried out for 7 days with the addition of 5% CKA and pineapple extract 1:1 (v/v) which were observed for sediment, bubbles, aroma, and condition of the cabbage. Fermenting the cabbage with the addition of food vinegar, a precipitate forms on the last day of fermentation. The characteristics of the starter *Lactobacillus* sp in the food vinegar treatment were clear, cloudy, had bubbles, and had a pungent odor. The *Lactobacillus* sp starter was treated with the addition of pineapple extract, on the 4th day there was a change in color and a white layer formed on the top of the liquid. There are many bubbles and it is dark cloudy yellow and there is sediment at the bottom of the liquid.

Making starter *Lactobacillus* sp. The ingredients used are fermented cabbage with food vinegar and pineapple extract. *Lactobacillus* sp. is a type of lactic acid bacteria. Cabbage is used as a fermentation medium, while food vinegar and pineapple extract are used as ingredients to help the growth of lactic acid bacteria. Cabbage waste fermentation increases the number of lactic acid bacteria. Lactic acid bacteria are naturally abundant on the surface of plants (vegetables) and dairy products (Aryani *et al*. 2015). In addition, according to Putri *et al*. (2014) orange juice can increase the growth of lactic acid bacteria, the higher the concentration of orange juice used, the nutrients for LAB growth will be fulfilled so that the total LAB will increase.

According to Widiyanti (2018) [14] the air bubbles in the Durham tube came from an aerobic incubation process at 37°C incubator for 24 hours. Bacteria *Lactobacillus* sp. F213 is a heterofermentative bacteria which not only produces lactic acid, but also produces other compounds such as CO2, acetic acid and ethanol, where acetic acid and ethanol compounds have an OH- group which can affect the pH value. *Lactobacillus* sp. F213 is a homofermentative bacteria, where during fermentation the bacteria not only produce lactic acid but also produce other compounds such as CO2, ethanol and acetic acid, so that the production of the lactic acid produced is also not optimal like homofermentative bacteria (Saraswati *et al*. 2021). Widiada (2021) states that lactic acid bacteria can grow at a temperature of 37°C or a growth temperature range between 10-45°C, and the optimum temperature for growth is between 20-40°C and grows at a low pH (pH 4.5) or at High pH (pH 9.6). In observing the aroma from day 1 to 7, there was a difference, namely on days 1 and 2 the aroma was still dominant of citrus, while on day 3 a slightly rotten smell typical of cabbage appeared. Then on the 4th to 7th day the orange aroma decreases and the typical cabbage smell increases. According to Suhery *et al*. (2015) the fermentation process of lactic acid bacteria emits a sour odor due to the production of lactic acid. Sour smell. This is due to the conversion of carbohydrates during fermentation. In addition, cabbage is a type of vegetable that is easy to decay. Then the observation of the condition of the cabbage can be seen in table 3 which shows that on days 1 and 2 the condition of the cabbage was still quite good. Then on the 3rd day a black mark appeared on jar 1 while on the 2nd jar the condition of the cabbage was still quite good. Then on the 4th to 7th day it starts to grow like white mushrooms which are increasing every day in jars 1 or 2. Mushrooms can grow during the aerobic process where during the fermentation process there is oxygen entering where oxygen and mushrooms can grow with ferment lactic acid and soluble carbohydrates (Wati *et al*. 2018). Making starter *Lactobacillus* sp. with cabbage and sugar was successfully marked by the growth of a white layer and a change in aroma.

Conclusion

The addition of 5% food vinegar and 1:1 (/v) pineapple extract in this study gave different results on the formation of starter *Lactobacillus* sp. Fermentation was carried out for 7 days at room temperature. The treatment for making *Lactobacillus* sp starter with the addition of pineapple was faster, which occurred on the second day, while the treatment with the addition of 5% food vinegar occurred on the 4th day with the results being cloudy, there were bubbles, there was sediment at the bottom of the liquid, and a white layer on upper layer.

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