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# Effect of Lactic Acid Bacteria Concentration on Modification of Banana Humble Flour by Fermentation

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**ABSTRACT**

*Banana weevil is a waste that has not been used much, however banana weevil has content lots of nutrition. So that need effort for utilise the banana weevil so that it can beneficial for society. This study used lactic acid bacteria fermentation method which aims to analyze the characteristics of modified banana weevil flour. Then thinly sliced banana weevil soaked for 2 hours inside sodium metabisulfite solution then soaked again use finished solution mixed with bacteria sour lactate with concentration 0;0,02;0,025;0,03 ml/L. After that hump dried and ground for become flour and tested characteristics. The results showed that the swelling power test level was highest at a concentration of 0.03 ml/L, which was 13.39 grams, the % solubility test was highest at a concentration of 0.03 ml/L with a value of 0.12%, the results of the viscosity test after being modified had the same value, namely of 1.4 mPa.s, for the results of reducing sugar content after being modified it decreased and a result of 4% was obtained.*



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## 1. INTRODUCTION

The increasing consumption of domestic flour could be due to the high consumption of processed wheat products which has led to higher wheat imports, in order to meet the needs of domestic people. Then, flour has a high gluten content which can cause damage to the small intestine resulting in general disruption of the absorption of nutrients that can enter the body (Rosdiana, 2009). Therefore, there is a great need for new alternatives for flour raw materials that use local food ingredients that are more economical and not imported products. Because one of the local food ingredients that can be used as a partial substitute or substitute for food diversification is banana tuber (Hidayah, Meddiati Fajri Putri, 2021).

Starch, as the most abundant natural polysaccharide second only to cellulose, is found in the roots, seeds, leaves of various plants, and some algae. Typically, starch granules consist of two main fractions: amylose, a type of linear polymer of glucose units with $\alpha$ (1→4) linkages and amylopectin, which is highly branched with many short chains connected via $\alpha$ (1→6) linkages to the linear part of the macro molecules. The differences in structure make these two components significantly different in both physical and chemical properties. For example, amylopectin dissolves more easily in hot water than amylose. Another significant difference is that only amylose can form a complex with iodine and make the solution appear blue-black in color. Due to the development of technology, the application fields of starch are expanded progressively and different techniques have been developed for modification of starch to overcome its shortcomings. These include poor processability and solubility in common organic solvents, retrogradation and syneresis, low shear stress resistance and thermal decomposition. In general, there are four categories of methods for starch modification: physical, chemical, enzymatic and genetic engineering respectively (Fan and Picchioni, 2020).

Fermentation is a method that has long been used in food processing with the aim of increasing shelf life, improving palatability (acceptability) and improving digestibility and increasing nutritional value (Fadlallah et al, 2010). This research used kapok banana weevil and lactic acid bacteria with the aim of determining the effect of the concentration of Lactic Acid Bacteria on the characteristics of banana weevil flour.

## 2. METHODS

Starch modification is designed to change the gelatinization characteristics, the relationship between solids and viscosity, the tendency for gel formation in starch dispersions, hydrophilic properties, the water holding power of starch dispersions at low temperatures, the dispersion's resistance to viscosity reduction by acids, or physical destruction and include the ionization properties of starch. origin (Jacobs and Delcour, 1998). Lactic acid bacteria have amylolytic properties, namely they are able to produce the enzyme amylase to degrade starch. Amylolytic lactic acid bacteria produce extracellular enzymes, namely amylase and pululanase, which can hydrolyze some natural starches into simple sugars and other oligosaccharides or dextrins. The $\alpha$-amylase enzyme will cut carbohydrates at the endo-$\alpha$ 1,4 bond to produce maltose and dextrin. Pululanase will cut carbohydrates at the endo-$\alpha$ 1,6 bond to produce linear dextrin. Starch fermentation by LAB shows microstructural changes, namely the formation of globular and lamellar structures. Changing the starch structure from crystalline to more porous

(amorphous), increases the ability to release amylose and reduces the starch gelatinization temperature (Edam, 2017).

Modification of Banana Weevil Flour

- Clean the banana hump from the midrib, dirt that is still attached, soil, roots and wash thoroughly.
- Cut the banana tubers into ±0.5 cm thick pieces with a knife and then wash them again until they are completely clean.
- Banana weevils are weighed 500 gram each and soaked in sodium bisulfite solution for 30 minutes to prevent the browning process.
- Wash it clean then soak it in lactic acid bacteria and water in a ratio of 1:1:0.01
- Then dried in the oven for 17 hours at 70˚C until dry.
- After drying, grind and sieve (60 mesh) until you get banana weevil flour kepok.

## 3. DATA ANALYSIS

The test parameters used in this research are characteristic tests which include swelling power test, % solubility test and viscosity test.

a. Swelling power test

Swelling power analysis using the Leach method was carried out by dissolving 0.1 gram of modified flour in 10 ml of distilled water and heating using a water bath at a temperature of 60°C for 30 minutes. Then centrifuged at 2500 rpm for 15 minutes to separate the supernantan and the paste formed. The swelling value is then determined from the comparison of the weight of the starch paste and the weight of the dry sample.

$$swelling\ power = \frac{starch\ paste}{dry\ sample}$$

b. % solubility test

Solubility analysis was carried out by dissolving 0.1 gram of modified flour in 10 ml of distilled water and heating using a water bath at a temperature of 60°C for 30 minutes. Then centrifuged at 2500 rpm for 15 minutes to separate the supernantant and the paste formed. 10 ml of supernantant was taken then dried in an oven and the weight of the dry precipitate was recorded.

$$\%solubility = \frac{dry\ precipitate}{sample\ weight} \times 100\%$$

c. Viscocity test

A total of 1 g of sample was dissolved in 100 mL of distilled water, heated in a boiling water bath for 20 minutes while stirring. The solution was then cooled to 50°C and its viscosity was measured using a Brookfield viscometer with spindle number 3 and a speed of 30 rpm.

## 4. RESULTS AND DISCUSSION

The research results showed that differences in LAB (Lactic Acid Bacteria) concentrations had an effect on the swelling power, solubility and viscosity of modified banana hump flour.

a. Swelling power

Swelling power is the maximum increase in volume and weight of starch during its expansion in water. The following is a graph of the results of research on modification of banana weevil flour using a fermentation method using lactic acid bacteria.

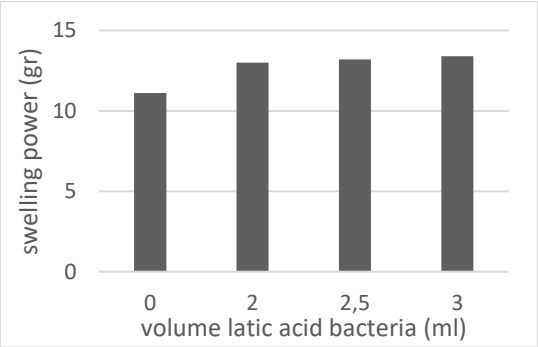


Figure 1. Effect of volume of lactic acid bacteria on swelling power values.

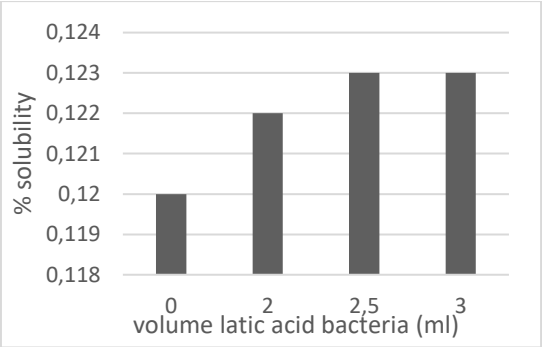


Figure 2. Influence of the Volume of Lactic Acid Bacteria on the % Solubility Value.

Figure 1 shows that differences in the volume of LAB (Lactic Acid Bacteria) have an effect on swelling power. The lowest value at a volume of 0 ml was 1.8 grams of lactic acid bacteria and the highest value at a volume of 3 ml was 2.01 grams. It can be interpreted that if the volume is greater, the swelling power value will increase.

This is because the amylose content is lower or the amylopectin in starch is higher. Fermentation by lactic acid bacteria increases the ability to release amylose. The increase in heating temperature causes the starch gelatinization process to run optimally, namely the amylose fraction decays out of the starch granules due to the starch granules breaking down, thereby reducing the amylose content.

b. % solubility

The mechanism of solubility and swelling power is that when starch is heated in excess water, the hydrogen bonds which play a role in stabilizing the starch structure are broken and replaced by hydrogen bonds in water so that the starch granules expand or increase in volume and the starch becomes more soluble. The following is a graph of the results of research on modification of banana weevil flour using a fermentation method using lactic acid bacteria.

From the research results, it can be seen that the relationship between increasing the volume of lactic acid bacteria and the % solubility value is directly proportional. If the volume increases, the % solubility value will also increase and the lowest value obtained is 1.2% at a volume of 0 ml then the largest value is 1.28% at a volume of 3. ml.

The % solubility value changes also because the amylose content is lower or the amylopectin in starch is higher. Fermentation by lactic acid bacteria increases the ability to release amylose. The increase in heating temperature causes the starch gelatinization process to run optimally, namely the amylose fraction decays out of the starch granules due to the starch granules breaking down, thereby reducing the amylose content.

c. Viscocity

In this study, viscosity was measured using a viscometer. The research results will be shown in the following graph.

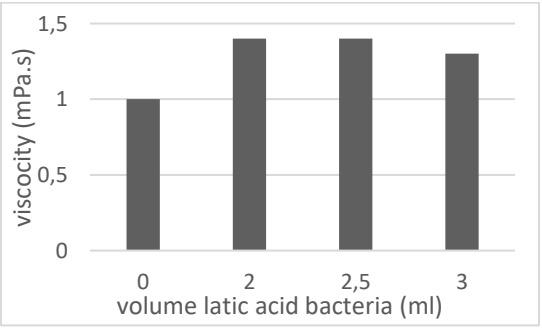

Figure 3. Effect of Volume of Lactic Acid Bacteria on Viscosity Values.

In the graph, the viscosity value increases in the second sample, namely from a volume of 0 ml to a volume of 2 ml, it increases by 0.4 then stabilizes to a volume of 3 ml. The thing that influences viscosity is the composition of starch, namely amylose and amylopectin. Fredriksson et al (1998) stated that amylopectin plays a role in development and the dough properties of starch and amylose inhibit development. Starch granules with high amylopectin content will produce more fluffy granules and high viscosity, while the amylose linear chains come out of the granules and create a continuous phase outside the granules along with lipids, thereby inhibiting swelling and producing a lower dough viscosity.

## 5. CONCLUSION

From the research that has been carried out, the following conclusions can be obtained:

a. The effect of the concentration of lactic acid bacteria on the characteristics of banana

b. weevil flour (swelling power, solubility and viscosity) is as follows:

• Swelling power: The relationship between the concentration of lactic acid bacteria and swelling power is that the greater the volume, the greater the swelling power value.

• Solubility: The relationship between the concentration of lactic acid bacteria and solubility is that the greater the volume, the greater the solubility value.

• Viscosity: The relationship between the concentration of lactic acid bacteria and viscosity is that the greater the volume, the greater the viscosity value.

c. The optimum concentration of lactic acid bacteria in modified banana weevil flour in this study was 3 ml with a swelling power value of 2.01 grams, a solubility value of 1.28% and a viscosity value of 1.4 mPa.s

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