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Processing of Your Banana Peel Waste (*Mussa paradisiaca*) into Organic Vinegar with the Addition of *Acetobacter aceti bacteria*

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Abstract: This study aims to determine the process of processing Awak banana peel waste (*Musa paradisiaca*) into organic vinegar by giving Acetobacter aceti bacteria and to determine the use of Acetobacter aceti bacteria to affect the processing of Awak banana peel waste into organic vinegar. This research was conducted from September to October 2022 at LAB MIPA USM, Banda Aceh. The method used in this study is a complete randomized design (RAL) with a 1 factorial pattern, namely the addition of Acetobacter aceti bacteria (P0=0%, P1=10%, P2=20%, P3=30% and P4=40%). Based on the results of the study, it shows a good treatment obtained at P1, namely with the addition of Acetobacter aceti bacteria as much as 10%. While the lowest results were obtained in P0 treatment without the addition of Acetobacter aceti bacteria. The results of the ANAVA test on vinegar color, vinegar taste, vinegar aroma and vinegar PH showed a real difference and the results of research on the amount of acetic acid obtained were (P0 = 0.6%, P1 = 6%, P2 = 4.8%, P3 = 4.2%, P4 = 3%). Then your banana peel waste can be used as a basic ingredient for making organic vinegar and Acetobacter aceti bacteria have a positive effect on processing your banana peel waste into organic vinegar.

Keywords: *Acetobacter aceti*; Banana peel waste; *Mussa paradisiaca*; Organic vinegar

Introduction

The banana plants (Musa paradisiaca) are the fast-growing herbaceous perennials arising from underground rhizomes (Saro, 2022). Bananas (Musa sp., family Musaceae) develop in clusters with an average fruit weight of about 125 g with almost 25% dry matter and 75% water. Bananas are the second largest produced fruit, accounting for 16% of total fruit production worldwide (Mishra et al., 2023). Bananas are a fruit loved by most of the world's population, including in the country. The number of banana availability is high in Indonesia, which is 2,074,305 stalks/year. Fast banana ripening time can result in many bananas not being utilized optimally, especially kepok bananas. The advantages of banana kepok are its low price and fast ripening time (Hidayatulloh et al., 2019). Waste that is still rarely used is banana peels. Banana peel is a banana fruit waste that is quite a lot and has not been used in reality, only disposed of as organic waste or used as animal feed Banana fruit consumption produces waste through its skin which accounts for about 30% of the weight of the fruit (Segura-Badilla et al., 2022). The consumption of fruits and vegetables involves the disposal of inedible parts, thus posing challenges such as waste management and environmental pollution (Gómez Montaño et al., 2019). If banana peels can be used in large quantities, they will have a high selling value when used (Welkriana et al., 2022). Waste management can be done based on the 4 R principles, namely reduce, reuse, recycle, and replace (Kusminah, 2018).

In Aceh, bananas are fruit crops that have the greatest potential and provide the largest contributor in

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fruit production. One type of banana produced is a crew banana. Musa paradisiaca (plantain) is an edible food plant and African medicinal plant. The fruit is consumed, boiled, baked, fried or made into plantain flour. It is used against ulcers, diabetes and as an antimicrobial agent (Ahmad, 2016). The process is simple, the capital requirement is limited, and banana wastes can be used for the production of acetic acid (Gonelimali et al., 2018). This amount of production and consumption is accompanied by a large amount of waste production which reaches 30–40% of the total weight which produces around 3.5 million tons of banana peel waste (BP) per year (Acevedo et al., 2021; Voora et al., 2019).

Aqueous extracts from raw banana peels also had a strong antiulcer effect on male (albino) Wister rats. The skin is also richer in cellulose than the inside (Ikpeazu OV et al., 2017). *Musa paradisia* ca has various "phytochemical" bioactive compounds such as flavonoids, phenolics, vitamins and proteins and due to the presence, these bioactive compounds, *Musa paradisiaca* shows promising antioxidant activity (Rai et al., 2021) as well as and therapeutic effects (Sidhu et al., 2018). In line with research conducted by Manzoor et al. (2021) this fruit contains many valuable nutrients, antimicrobial, and natural antioxidants. Recently, Vu et al. (2018) has also studied phenolic compounds and their potential health benefits derived from banana peels.

Bioactives reported in Musa paradisiaca extract include polyphenols (hydroxyl benzoic acid, phenolic acid as gallic acid, gentisic acid, protocatechuic acid, vanillin, ca ffeic acid, vanillic acid, syringic acid, p-coumaric acid, ferulic acid, chlorogenic acid, sinapic acid and catechol. Also, flavonoids as catechins, quercetin, rutin, and epicatechin have been reported in *Musa paradisiaca* (Gadelha et al., 2021). Based on pr esent investigations and previous findings, Musa paradisiaca is a powerful source of bioactive compounds.

Vinegar is an organic chemical compound known as an acid and aroma giver in food. Vinegar acid is a processed food obtained through a fermentation process (Luzón-Quintana et al., 2021). Vinegar is a traditional fermented product that can be made from a variety of raw materials (Tanamool et al., 2020). Actually, many people have used fruit juice and fermentation techniques to make vinegar such as apple vinegar (Martini, 2021), wine and guava (Kumar et al., 2017) but it is still rare to use waste from fruit peels to be used as vinegar. The production of fruit vinegar as a way of utilizing fruit by-products is an option that is widely used by the food industry, because excess fruit or second quality can be used without reducing the quality of the final product. The vinegar properties of vinegar and its subsequent impact on the organoleptic properties of the final product allow almost all types of fruit to be used for its manufacture (Luzón-Quintana et al., 2021). According to Food and Agriculture Organization of the United Nations (2019) 21.6% of fruits produced in the world are wasted, starting from the post-harvest stage to distribution. Some examples of maceration of vinegar with other fruits such as bananas, passion fruit, or apples have also been found in the literature (Launholt et al., 2020).

Based on these problems, this study will examine the "Processing of Crew Banana Skin Waste (*Mussa paradisiaca*) into Organic Vinegar with the Addition of *Acetobacter aceti bacteria*".

Method

This research was carried out from September 17, 2022 to October 21, 2022 at the MIPA laboratory Universitas Serambi Mekkah, Banda Aceh.

The tools used are knives, scales, pots, stoves, filters, drip pipettes, bottles, lebel paper, measuring flasks, Erlenmeyer, burettes, clamps and statifs, and measuring cups. The ingredients used are banana peel, yeast (*Saccharomices cereviceae*), Acetobacter aceti bacteria, NaOH, pp indicators and aquades.

Research Procedure

The banana peel is cut into small pieces using a knife. Banana peels are washed using water. Banana peel in boiled. Banana peel liquid is filtered using a cloth filter. Banana peel liquid is given the addition of *Saccharomyces cereviseae* and left to ferment alcohol for 2 days. Banana peel liquid is diluted with Acetobacter aceti bacteria with concentrations of 0%, 10%, 20%, 30% and 40%. Banana peel liquid is fermented for 36 days. Banana peel vinegar.

Making Awak Banana Skin Liquid (Musa paradisiaca)

In this study, waste from banana peel (Musa paradisiaca) was obtained from banana plants in Garot Village, Darul Imarah District, Aceh Besar. The banana peel used is yellow. Next, the banana peel is cut into pieces or chopped and washed thoroughly using mineral water, then the banana peel is boiled. After boiling, the liquid is filtered using a strainer.

*Addition of Saccharomyces cereviseae***.**

Banana peel liquid is then given the addition of Saccharomyces cereviseae and left to ferment alcohol for 2 days. Banana peel liquid is then given the addition of *Saccharomyces cereviseae* and left to ferment alcohol for 2 days.

Dilution of Awak Banana Skin Liquid (Musa paradisiaca)

Banana peel liquid (*Musa paradisiaca*) is further diluted with *Acetobacter aceti bacteria* to obtain the desired concentration of 0%, 10%, 20%, 30% and 40%. Making the liquid concentration for each treatment is to use the following dilution formula:

$$\frac{\text{Volume of liquid before dilution x Concentration before dilution}}{\text{Volume of liquid after dilution x Concentration after dilution}} \quad (1)$$

Preparation of Vinegar Making Media

The tool used as a container in making vinegar is a bottle that has been sterilized first.

Observed Parameters

The fermented banana peel solution is then observed every 6 days until the 36th day to see the vinegar color, vinegar taste, vinegar aroma, and vinegar pH. On the last day of the study, which was the 36th day, testing of ripe vinegar acetic acid levels was carried out. The assessment indicators are the color of vinegar was tested using direct observation, namely at levels 1 (dark cloudy brown), 2 (dark brown), 3 (cloudy light brown) and 4 (light brown). The taste and aroma of vinegar are carried out using direct observation, namely at levels 1 (not acidic), 2 (slightly acidic), 3 (acidic) and 4 (very acidic). PH is measured using a PH meter. The fermented banana peel solution is then observed every 6 days until the 36th day to see the vinegar color, vinegar taste, vinegar aroma, and vinegar pH. On the last day of the study, which was the 36th day, testing of ripe vinegar acetic acid levels was carried out.

Data Processing

Techniques Data that has been collected is tabulated in the form of tables, this is done to facilitate the reading of tables, or facilitate the process of data analysis. The tabulated data is then analyzed using Analysis of Variance (ANAVA), with the following equation:

$$Y = \mu + \tau + \epsilon \quad (2)$$

Remarks:
Y = Observation value of experimental results
μ = Mean value of expectation
τ = Effect of treatment factor
∈ = Effect of error

To accept or reject the hypothesis, a test level (5%) is used provided that if F-calculate ≥ F-table, then between treatments there is a real difference then Ha is accepted. Furthermore, if there is a noticeable difference, then a further test is carried out with the following conditions if the KK is large (at least 10% then the condition is homogeneous), if the follow-up test used should be the Duncan Real Distance test (JNTD). If the KK is medium (between 5-10% in homogeneous conditions or between 10-20% in heterogeneous conditions), the follow-up test used should be the Smallest Real Difference (BNT) test. If the KK is small (maximum 5% in homogeneous conditions), the follow-up test used should be the Honest Real Difference (BNJ) test. The formula Diversity coefficient is:

$$\text{Diversity coefficient } \frac{\sqrt{}}{\text{Average of All Experiments}_x} \text{x } 100\% \quad (3)$$

If the price difference between the treatment ≥ Duncan Real Distance (JNTD) value, then between treatments there is a noticeable difference. Conversely, if the price difference between the treatment < JNTD, then there is no real difference.

To find out the level of Acetic Acid produced from each treatment, it is necessary to calculate the level of Acetic Acid expressed in percentage (b/v). Then the formula for calculating the rate is as follows:

$$\text{percentage} = \frac{\text{Chemolarity of solution}}{\text{Relative molecular mass}_x} \text{x } 100\% \quad (3)$$

Result and Discussion

The banana is the most used fruit worldwide for several reasons, as it is a delicious and rich source of nutrients and helps improve mental health (Głąbska et al., 2020). Bananas are widely used by various food, juice, cosmetics, and textile industries (Axelos, 2017). From the results of observations made on the processing of waste banana peel crew (*Musa paradisiaca*) into organic vinegar with the addition of *Acetobacter aceti bacteria* with different concentrations for 36 days gave a different effect on each treatment. The data obtained are presented in the form of the following tables and graphs: to see the effect of adding Acetobacter aceti bacteria on the color of banana peel vinegar in each treatment, ANAVA test can be done.

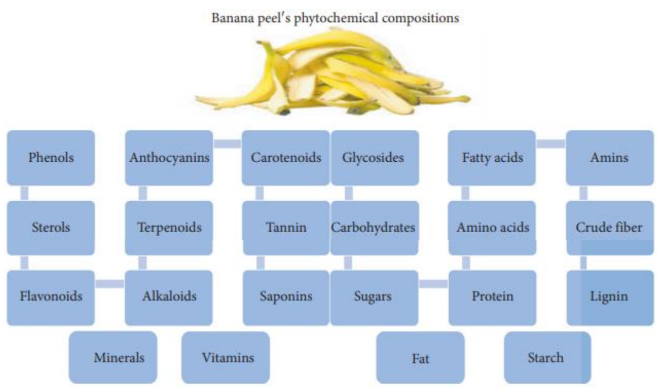

Figure 1. The chemical compositions of banana peels (Aboul-Enein et al., 2016)

Table 1. Results of Analysis of Variance Test (ANOVA) on Color Changes in Banana Peel Vinegar (*Musa paradisiaca*)

Sources of Diversity	Sum of Squares	Free degree	Middle Square	F count	p-value	F table
Treatment	22.22	2				
Error	128.46	87	1.47	7.52	9.92	3.10
Total	128.49	89				

Based on the analysis of color change variants in banana peel vinegar (*Musa paradisiaca*) showed a real different effect on vinegar color change. This is because F count = 7.52 ≤ F table = 3.10.

Table 2. BNT Test Results for Color Changes in Banana Peel Vinegar (*Musa paradisiaca*)

Average	Average treatment P0 (0%)	P1 (10%)	P2 (20%)	P3 (30%)	P4 (40%)
P0 (7.5)	-	5*	6*	11.5*	17.5*
P1 (11)	-	-	1*	6.5*	12.5*
P2 (12.5)	-	-	-	5.5*	11.5*
P3 (16)	-	-	-		6*
P4 (22)	-	-	-	-	-

Remarks: Significantly different at the level of 0.05

To see the effect of adding *Acetobacter aceti bacteria* on the taste of banana peel vinegar in each treatment, ANAVA test can be done.

Table 3. Results of Analysis of Variance Test (ANOVA) on Changes in the Taste of Banana Peel Vinegar (*Musa paradisiaca*)

Sources of Diversity	Sum of Squares	Free degre	Midde Square	F count	p-value	F table
Treatment	15.55	2	7.78			
Error	72.73	87	8.36		9.11	3.10
Total	72.88	89		9.30		

Based on the analysis of flavor change variants in banana peel vinegar (*Musa paradisiaca*) showed a significantly different effect on changes in vinegar taste. This is because F count = 9.30 ≥ F table = 3.10.

Table 4. BNT Test Results on Taste Changes in Banana Skin Vinegar (*Musa paradisiaca*)

Average	Average Treatment P0 (0%)	P1 (10%)	P2 (20%)	P3 (30%)	P4 (40%)
P0 (7.5)	-	3.5*	5*	8*	8.5*
P1 (11)	-	-	1.5*	4.5*	5*
P2 (12.5)	-	-	-	3*	3.5*
P3 (16)	-	-	-	-	0.5*
P4 (22)	-	-	-	-	-

Remarks: Significantly different at the level of 0.05

To see the effect of adding Acetobacter aceti bacteria on the taste of banana peel vinegar in each treatment, ANAVA test can be done.

Table 5. BNT Test Results for Changes in the Taste of Banana Peel Vinegar (*Musa paradisiaca*)

Sources of Diversity	Sum of Squares	Free degree	Middle Square	F count	p-value	F table
Treatment	15.55	2	7.78			
Error	72.73	87	8.36	9.30	9.11	3.10
Total	72.88	89				

Based on the analysis of aroma change variants in banana peel vinegar (*Musa paradisiaca*) showed a significantly different effect on changes in vinegar aroma. This is because F count = 9.303391 ≥ F table = 3.101296.

Table 6. BNT Test Results for Changes in the Aroma of Banana Peel Vinegar (*Musa paradisiaca*)

Average	Average Treatment P0 (0%)	P1 (10%)	P2 (20%)	P3 (30%)	P4 (40%)
P0 (7.5)	-	3.5*	5*	8*	8.5*
P1 (11)	-	-	1.5*	4.5*	5*
P2 (12.5)	-	-	-	3*	3.5*
P3 (16)	-	-	-	-	0.5*
P4 (22)	-	-	-	-	-

Remarks: Significantly different at the level of 0.05

To see the effect of adding *Acetobacter aceti bacteria* on PH in banana peel vinegar in each treatment, ANAVA test can be done.

Table 7. Results of Analysis of Variance Test (ANOVA) on Changes in PH of Banana Peel Vinegar (*Musa paradisiaca*)

Sources of Diversity	Sum of Squares	Free degree	Middle Square	F count	p-value	F table
Treatment	14.06	2	7.03			
Error	38.25	87	4.32	7.26	8.50	3.10
Total	38.51	89				

Based on the analysis of variances of PH changes in banana peel vinegar (*Musa paradisiaca*) showed a markedly different effect on changes in the PH of vinegar. This is because F count = 7.26 ≥ F table = 3.10.

Table 8. BNT Test Results for Changes in PH of Banana Peel Vinegar (*Musa paradisiaca*)

Average	Average treatment				
	P0 (0%)	P1 (10%)	P2 (20%)	P3 (30%)	P4 (40%)
P0 (7.5)	-	-0.6*	-1.3*	-3.2*	-8.2*
P1 (11)	-	-	-0.7*	-2.6*	-7.6*
P2 (12.5)	-	-	-	-1.9*	-6.9*
P3 (16)	-	-	-	-	-5*
P4 (22)	-	-	-	-	-

Remarks: Significantly different at the level of 0.05

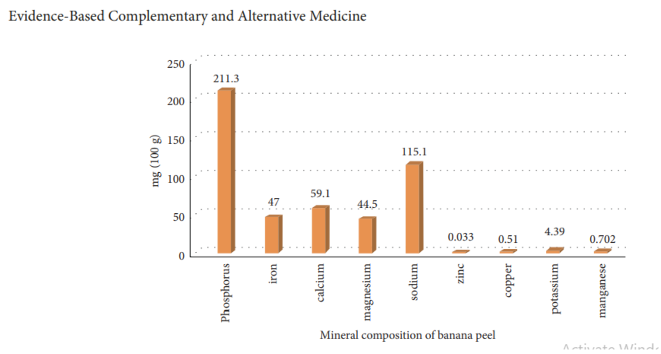

Figure 2. Mineral composition of banana peel (Hassan et al., 2018)

Table 9. Acetic Acid Content of Organic Vinegar

Concentration	Concentration	Acetic Acid Levels
P0	0%	0.6%
P1	10%	6%
P2	20%	4.8%
P3	30%	4.2%
P4	40%	3%

From the table above, we can know the level of acetic acid in vinegar, which is an observation made on day 36. The titration results obtained different levels of vinegar acetic acid in each treatment. In the treatment P0 (0%) acetic acid content of vinegar 0.6 %, P1 (10%) acetic acid content 6%, P2 (20%) acetic acid content 4.8%, P3 (30%) acetic acid content 4.2%, and P4 (40%) acetic acid content 3%. In line with research conducted by Abdullah et al. (2023) semeru banana peel is organic waste that is only used as animal feed and does not harm the environment. The main component of banana peel is carbohydrates that can be used as substrates during the fermentation process to produce lactic acid. The main volatile compound in vinegar that gives its own unique taste and flavor is acetic acid. Other volatile compounds are alcohols, acids, esters, aldehydes and ketones (Ho et al., 2017).

The results of research on color, taste, aroma, PH and acetic acid levels in the processing of waste banana peel crew (*Mussa paradisiaca*) with the addition of Acetobacter aceti bacteria showed that vinegar observed for 6 days to day 36 experienced changes in color, taste, aroma, PH and acetic acid levels in vinegar.

Color is one component that can provide clues about changes in food and one of the benchmarks for the presence or absence of product changes.

Observation of color is carried out by observing sensory data. Changes in color in organic vinegar occur changes from dark cloudy brown, dark brown, cloudy light brown and light brown. The color change is caused by the addition of Acetobacter aceti bacteria. On day 6, the vinegar color change in each treatment is the same, namely dark brown turbid vinegar. On day 12 in the P0 treatment the control formula (0%) did not change color while in the treatment P1 (10%), P2 (20%), P3 (30%), and P4 (40%) there was a change in color in vinegar to dark brown. On the 18th day of the P0 treatment the control formula (0%) did not change color while in the P1 (10%), P2 (20%), P3 (30%), and P4 (40%) treatments there was a change in color in the vinegar to dark brown. On the last day, namely the 36th day of the P0 treatment formula control (0%) there was no color change while in the P1 treatment (10%), P2 (20%), P3 (30%), and P4 (40%) there was a color change in vinegar to light brown.

Significant changes on day 36 when compared to the first day observations were that the best vinegar color obtained at P1 (10%), P2 (20%), P3 (30%) and P4 (40%) produced the best vinegar color which was light brown with an average value of 4 and P0 (0%) did not produce the best vinegar color which was cloudy brown with an average value of 1.

Changes in taste in organic vinegar occur changes from not sour, somewhat sour, sour and very acidic. The change in taste is due to the addition of Acetobacter aceti bacteria. On the 6th day, the change in the taste of vinegar in each treatment is the same, that is, the vinegar taste is not sour. On the 12th day, the change in vinegar taste in each treatment was different, some were not sour and slightly sour, but in the control formula (0%) there was no change in taste. On the 18th day, the change in vinegar taste in each treatment was different, some were not sour and slightly sour, but in the control formula (0%) there was no change in taste. On the 24th day, the change in vinegar taste in each treatment was different, some were not sour, slightly sour and sour, but in the control formula (0%) there was no change in taste. On the 30th day, the change in vinegar taste in each treatment was different, some were not sour, slightly sour and sour, but in the control formula (0%) there was no change in taste. On the 36th day, the change in the taste of vinegar in each treatment was different, some were sour and very sour, but in the control formula (0%) there was no change in taste, that is, the vinegar taste was not sour. So in the change in taste that occurs it is seen that the longer the storage on vinegar, the vinegar will be more acidic.

A significant change on day 36 when compared to the observation on the first day was the best vinegar taste obtained at P1 (10%) and P2 (20%), namely the taste of sour vinegar with an average value of 3. At P0(0%), P3(30%) and P4(40%) did not produce the best vinegar taste, namely P0(0%) non-sour vinegar taste with an average value of 1, P3(30%) and P4(40%) very sour vinegar taste with an average value of 4.

Changes in the aroma of organic vinegar occur changes from not sour, somewhat acidic, acidic and very acidic. On the 6th day, the change in the aroma of vinegar in each treatment is the same, that is, the aroma of vinegar is not sour. On day 12, the change in vinegar aroma in each treatment was different, some were not acidic and slightly acidic, but in the control formula (0%) there was no change in aroma. On day 18, the change in vinegar aroma in each treatment was different, some were not acidic and somewhat acidic, but in the control formula (0%) there was no change in aroma. On day 24, the change in vinegar aroma in each treatment was different, some were not acidic, somewhat acidic and sour, but in the control formula (0%) there was no change in aroma. On the 30th day, the change in vinegar aroma in each treatment was different, some were not acidic, somewhat acidic and sour, but in the control formula (0%) there was no change in aroma. On day 36, the change in the aroma of vinegar in each treatment was different, some were acidic and very acidic, but in the control formula (0%) there was no change in aroma, namely the aroma of vinegar was not sour. So in the change in aroma that occurs it can be seen that the longer the storage on vinegar, the vinegar will be more acidic.

A significant change on day 36 when compared to the observation on the first day was the best vinegar aroma obtained at P1 (10%) and P2 (20%), namely the aroma of sour vinegar with an average value of 3. At P0(0%), P3(30%) and P4(40%) do not produce the best vinegar aroma, namely P0(0%) non-sour vinegar taste with an average value of 1, P3(30%) and P4(40%) very sour vinegar aroma with an average value of 4.

Changes in the pH of organic vinegar occur changes of 6.0 – 3.4. Changes in vinegar observed from day 6 to day 36 of vinegar PH continued to decrease but in the treatment of the control formula P1 (0%) did not change. On the 6th day, the change in the PH of vinegar in each treatment was not the same. On day 12 there was a change in the PH of vinegar in each treatment, namely in the treatment of P2 (20%), P3 (30%) and P4 (40%), but in the control formula P1 (0%) and P2 (20%) there was no change in PH. On day 18 there was a change in the PH of vinegar in each treatment, but in the control formula P1 (0%) there was no change in PH. On day 24 there was a change in the PH of vinegar in each treatment, but in the control formula P1 (0%) there was no change in PH. On day 30 there was no change in the PH of vinegar in each treatment. On the last day, day 36, there was a change in the PH of vinegar in each treatment, but in the control formula P1 (0%) there was no change in PH. The longer the pH will decrease or become more acidic. In line with Juniawati et al. (2017) said that the effectiveness of banana peel vinegar at room temperature is better than at cold temperatures. This is thought to be because at room temperature, there is a decrease in pH value during storage while at cold temperatures there is no change in pH.

A significant change on day 36 when compared to the observation on the first day was that the pH of vinegar was best obtained at P1 (10%) and P2 (20%) with an average value of 4.1. At P0(0%), P3(30%) and P4(40%) did not produce the best pH of vinegar, namely P0(0%) PH of vinegar with an average value of 5.9, P3(30%) and P4(40%) PH of vinegar with an average value of 3.4.

Testing of acetic acid levels contained in organic vinegar solution on day 36. The titration results obtained different levels of vinegar acetic acid in each treatment. The results of the acetic acid content test analysis obtained in the treatment of P0, P1, P2, P3 and P4 were respectively 0.6%, 6%, 4.8%, 4.2% and 3%.

The highest acetic acid produced in the treatment with the addition of Acetobacter aceti concentration as much as 10%. This is because Acetobacter aceti will react optimally under conditions of adding a concentration of 10% of the amount of fermented raw materials. In line with research conducted by Chalchisa et al. (2021) to get optimal vinegar acid results, a good concentration of Acetobacter aceti to be inoculated is 10% of the total solution, and a solution can be said to be vinegar if it contains at least 3% acetic acid or 3 g/ 100mL. Banana peel vinegars have higher antioxidant activity and total polyphenol content similar to the commercial balsamic vinegars (Prisacaru et al., 2021).

Conclusion

Based on research processing your banana peel waste (mussa paradisiaca) into organic vinegar with the addition of Acetobacter aceti bacteria it can be concluded that banana peel waste can be used as an organic vinegar manufacture. The addition of Acetobacter aceti bacteria to the processing of your banana peel waste (mussa paradisiaca) into organic vinegar has a positive effect on organic vinegar. Research results on vinegar color, vinegar taste, vinegar aroma, vinegar PH and acetic acid content showed the best results obtained at P1 (10%), namely light brown vinegar color with an average value of 4, sour vinegar taste with an average value of 3, sour vinegar aroma with an average value of

3, vinegar PH with an average value of 4.1 and acetic acid as much as 6%. ANAVA test results on vinegar color, vinegar taste, vinegar aroma and vinegar PH showed a noticeable difference.

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Author Contributions
Conceptualization: Armi, Roslina, Data curation: Desi Sri Pasca Sari Sembiring, Evi Apriana, Husainah, Funding acquisition: Desi Sri Pasca Sari Sembiring, Methodology: Roslina, Husainah, Visualization: Armi, Desi Sri Pasca Sari Sembiring, Husainah, Elvitriana. Writing–original draft: Elvitriana, Husanah, Armi, Writing–review & editing: Armi, Desi Sri Pasca Sari Sembiring, Roslina, Elvitriana.

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Conflicts of Interest
The authors declare no conflict of interest.

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