The Effect of Pineapple Juice Concentration (Ananas comosus L.) and Pectin Concentration on Pineapple Milk Powder Characteristics

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Abstract. The processing of dairy products can result in ready-to-serve or ready-to-drink products. The process of drying generally turns dairy products into powder that must first be dissolved. A randomized block design with a 3x3 factorial analysis with just two components was used in this research, factors namely factor N (pineapple juice concentration) which consisted of 3 levels, namely n 1: 10%, n2: 20%, and n3: 30%, and factor P (pectin concentration) which consisted of 3 levels, namely p1: 0.1%, p2: 0.3% and p3: 0.5%. In this research, chemical interactions including pH, vitamin C levels, and water content were reviewed. Dissolution time, insolubleness, hygroscopicity, L* a* b* color intensity, and yield quantity are characteristics of physical interactions. Organoleptic responses include color, aroma, taste, and after taste. pineapple juice's impact on the body's chemistry, physiology, and organoleptic response. Water content, pH level, dissolving rate, insoluble, color intensity, and organoleptic reaction to aftertaste are all affected by pectin concentration. Water content, vitamin C levels, and color intensity values *L and *b are all impacted by the interaction between pineapple juice concentration and pectin concentration. Keyword: Milk Powder, Pineapple Juice, Pectin.

1 Introduction

Pineapple (*Ananas comosus* L.) is a type of fruit that has distinctive characteristics in terms of aroma, taste and color that most people like [1]. The main component that makes up pineapple fruit is Vitamin C of 20 mg / 100 g of pineapple fruit [2]. The processing of pineapple into various products is one of the efforts to reduce post-harvest loss, because in a fresh state the pineapple fruit has a high moisture content of 85.3g / 100g [3] and is classified as a type of climacteric fruit so that it cannot last long (*perishable*) if stored fresh.

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One way that can be done to overcome this is to process pineapple into a processed product such as pineapple milk powder.

Dairy products derived from milk can be packed and consumed directly or they can be brewed first and then consumed. Generally, powdered milk is created of dairy products that need to be warmed before consumption.. A way to add value to fresh milk and extend its shelf-life is to turn it into powdered milk.

The process of drying entails removing the moisture from a substance. According to [4] one of the techniques used for preserving foods is drying. The purpose of the drying process is to produce solid, dry products that are easier to transport because of their smaller volume, simplicity of handling, and ability to fit in less space. It also assists in reducing costs and eliminate challenges associated with packing, handling, transportation, and storage.

Instant powder beverage products or milk powder, using the drying temperature in the process of making their products. In this process, it is feared that the loss of several important substances such as vitamins, antioxidant compounds, and minerals due to inappropriate drying temperatures. Drying with a drum is very cook for most heat-sensitive products, as it is exposed to high temperatures in just a few seconds. In using this method, the material that must be avoided is a material that is too liquid because it will result in an increase in *lost product* during the drying process, so one of the solutions is needed a stabilizer / thickener.

In the processing of fresh milk into powdered milk with a drying process, a stabilizer is needed. The function of stabilizers in the manufacture of milk powder is as a thickening agent, filler, and gelling material [5]. Commonly used stabilizers include gelatin, carboxy methyl cellulose (CMC), gum arabic, carrageenan, sodium alginate, and pectin.

One of the fillers that has good potency but a low number of users is trehalosa. Trehalosa is one of the disaccharide sugars that can be used as a filler as well as a sweetener. Based on [6], trehalosa has a level of sweetness that is between 45 to 50% sucrose. A important purpose of trehalosa in food is that besides to being able to be utilized in low-calorie dishes, trehalosa might have a role in protecting and maintaining cell structures in food and stable against heat.

2 Material, Tools, and Research Methods Material

Fresh cow's milk picked up from cattle ranches in Cihanjuang Village, Bandung City, pineapple juice produced from pineapple fruit, pectin, and trehalos disaccharide sugar fillers are the components used to create pineapple milk powder. Aquades and DFIF solution were the analyzing materials used for the research.

2.1 Tool

The tools used in the process of making pineapple milk powder are *drum dryer* machines, *homogenizers*, *choppers*, *juicers, trays*, *vibratory screens*, containers, spatulas, knives, sieves, and digital scales.

The tools used for analysis in the study are *magnetic stirrer*, *moisture analyzer*, *spectrophotometer, colorimeter*, analytical scale, measuring flask, measuring flask, beaker, drip pipette, size pipette, micropipette, funnel, stirring rod, crucible pliers, filter paper, and pH meter, viscometer, PSA (*Particle Size Analyzer*) and SEM (*Scanning Electron Microscope*).

2.2 Research Methods

This research consists of 2 studies, namely preliminary research and main research.

2.3 Research Design

In this research, a factorial pattern in the Randomized Group Race (RAK) was used as the experimental design model. The main study had a factorial of 3x3 with 2 repeats, so 18 experimental units were obtained. The concentration factor of pineapple juice consists of 3 levels, namely 10%, 20% and 30%. The pectin concentration factor consists of 3 levels, namely 0.1%, 0.3% and 0.5%.

2.4 Preliminary Research

The preliminary research carried out is the determination of vitamin C levels in pineapple juiceto determine the comparison of vitamin C levels in pineapple juice with pineapple milk powder and pH measurements in pineapple juice. Furthermore, the measurement of the viscosity of the mixture of milk and pineapple in the process of making pineapple milk powder to obtain the viscosity in accordance with the *drum dryer,* as well as the analysis of the moisture content in pineapple milk powder.

The response to be used is a chemical response. The chemical response that will be carried out is the analysis of vitamin C levels by spectrophotometry method and pH value for pineapple juice, while the water content analysis is for pineapple milk powder products.

2.5 Main Research

The primary goal of the research was to identify the effects of the pectin and pineapple juice concentration factors. The thermogravimetric method's water content, the spectrophotometric method's vitamin C level, the reading of pH from a pH meter, the water soluble time, solubility, and hygroscopic test, the colorization method's color intensity, the total yield calculation, the scanning electron microscope (SEM), and the particle size analyzer (PSA) are the results that are submitted. Hedonic test method to analyze organoleptic responses using characteristics of color, scent, taste, and aftertaste.

2.6 Procedure

The procedure is divided into 2 stages, namely making pineapple juice and making pineapple milk powder.

2.7 Pineapple Juice Making

Pineapple fruit is carried out the process of sorting, washing, *trimming*, reducing size, extraction using *a juicer,* filtering and weighing.

2.8 Pineapple Milk Powder Making

The raw materials used include fresh cow's milk, pineapple juice, pectin, and trehalose. All raw materials are weighed according to the formulation, then the materials are mixed, the drying process is carried out using a *drum dryer* with a temperature of 130 °C. After

the drying process, the sifting process is carried out using *mesh* 80 so that pineapple milk powder products are obtained.

3 Results and Discussion

3.1 Preliminary Research Results

Based on the results of preliminary research, vitamin C levels of pineapple juice and pineapple milk powder found a decrease in vitamin C levels in the sample. This happens because in the manufacture of pineapple milk powder there is a drying process using a *drum dryer* machine with a temperature of 120-130 °C. Foodstuffs that contain vitamin C when exposed to hot temperatures reaching 87 degrees Celsius for only 2 minutes, the vitamin C content will be lost by as much as 10%. The results of preliminary research testing vitamin C levels in pineapple juice and pineapple milk powder is shown in the table 1.

Table 1. Data from the Analysis of Vitamin C Levels in Preliminary Research

Sample	Vitamin C Levels (mg/100 grams)
Pineapple Juice	24.81±2.25
Pineapple Milk Powder	8.92±0.01

Based on the results of preliminary studies, pH measurements of pineapple juice, milk, and a mixture of milk and pineapple juice obtained different pH in each sample. This happens because as the concentration of pineapple juice increases in the mixture of milk and pineapple juice will cause a decrease in pH in milk, the condition is caused because the pH of pineapple juice is lower than the pH of milk. The results of preliminary research on pH measurements in pineapple juice, milk, and a mixture of milk and pineapple juice is shown in the table 02.

Table 2. Data from the Analysis of pH Value of Preliminary Research

Sample	pH value
Pineapple Juice	3.83±0.03
Milk	6.56±0.08
Mixture of Milk and Pineapple Juice	4.60±0.04

Based on the results of preliminary research, the viscosity of a mixture of milk and pineapple juice with several concentrations of pectin obtained a different viscosity of the mixture in each sample. This happens because as the concentration of pectin increases in the mixture of milk and pineapple juice, it will increase the viscosity of the mixture. Pectin has hydrophilic properties and in the presence of soluble pectin heating will form a fine fiber, the structure is able to hold liquid. The higher the concentration of pectin added, the water content in the juice cannot move freely so that there is an increase in viscosity. The results of preliminary research on viscosity testing in a mixture of milk and pineapple juice is shown in the table 3.

Table 3. Preliminary Research Viscosity Analysis Results Data

Sample	Viscosity (cP)
Milk and Pineapple Juice Mixture (Pectin 0.1%)	4.28±0.52
Mixture of Milk and Pineapple Juice (Pectin 0.3%)	5.66±0.16
Mixture of Milk and Pineapple Juice (Pectin 0.5%)	7.73±0.16

Based on promptly study results, liquid milk's water content decreased when pineapple milk powder was added. [7] The composition of fresh milk consists of 87% water. The decrease in moisture content occurs due to the drying process of milk which involves the process of heat transfer and mass transfer. Heat transfer occurs from the heating medium (air) to the milky liquid. Along with the transfer of heat, there is also a transfer of liquid masses into the air. The result of the mass transfer event is a reduction in the moisture content of liquid milk so that it will become powdered milk. The results of the water content analysis show that the water content in pineapple milk powder meets the SNI water content standards regarding the maximum milk powder quality requirement of 5% w/w [8].

Tabel 4. Data from the Analysis of Water Content of Preliminary Research

Sample	Moisture Content (%)
Pineapple Milk Powder	3,39

3.2 **Main Research**

Based on the design of the experiment, a variance analysis (ANOVA) can be made.

3.2.1 Results of Chemical Response Analysis

Thermogravimetric analyses of water content, vitamin C levels, and pH levels are all utilized to identify the chemical response in this research.

3.2.1.1 Water Content of Thermogravimetric Method

In materials that have a low moisture content (3-7%) can reduce the possibility of microbial growth and damaging chemical reactions such as hydrolysis and fat oxidation (Winarno, 2004).

Table 5. Data on the Results of Water Content Analysis of Thermogravimetric Method in Pineapple Milk Powder

Treatment	Moisture Content (%)
n1p1	2,40%
n1p2	2,87%
n1p3	2,87%

n2p1	3,43%
n2p2	3,39%
n2p3	3,82%
n3p1	3,86%
n3p2	3,88%
n3p3	4,30%

Based on the calculation results, it was found that variations in the concentration of pineapple juice (N), variations in the concentration of pectin (P), as well as the interaction between the two factors (NP), had significant effects on the response of the water content of pineapple milk powder where F counted > F table. Therefore, additional Duncan tests were carried out in both variations at the level of 5%. The n1p1 treatment had the lowest water content of the thermogravimetric method of pineapple milk powder, with a value of 2.40%. The thermogravimetric method of pineapple milk powder produced findings with a water content of 4.30%, which were the highest in the n3p3 treatment.

[9] The higher the amount of water content added, the higher the amount of water content contained in foodstuffs. The water content is also influenced by the concentration of pectin, the more pectin increases, the water content will decrease. This is according to the fact that pectin will attract free water to the substance, causing the water content to decrease. Pectin added to food can establish a homogeneous dispersion system in food as well as increase the viscosity of the ingredients and reduce the water of the ingredients themselves[10].

3.2.1.2 Vitamin C Levels Spectrophotometric Method

Vitamin C or ascorbic acid has a molecular weight of 178 with a molecular formula of $C_6H_8O_6$. Vitamin C has water-soluble properties, but is slightly soluble in acetone and difficult to dissolve in chloroform, ether, and benzene. Vitamin C is more stable at low pH, easily oxidized by catalysts (Fe, Cu, ascorbic oxidase enzyme), rays, and high temperatures [11].

Table 6. Data from the Analysis of Vitamin C Levels in Spectrophotometric Methods in Pineapple Milk Powder

Treatment	**Vitamin C mg/100 g levels of ingredients**
N1P1	4,93
n1p2	4,94
N1P3	4,94
n2p1	8,11
n2p2	8,12
n2p3	8,12
n3p1	11,30
n3p2	12,09
n3p3	12,90

Based on the calculation data, variations in pectin concentration (P), and also the interaction between the two factors (NP) did not have a real effect on the response of vitamin C levels, while variations in the concentration of pineapple juice (N) had a real

effect on the response of vitamin C levels of pineapple milk powder where F calculated > F table so that in these variations further Duncan tests were carried out at the level of 5%.

The increasing concentration of pineapple juice will cause an increase in vitamin C levels as evidenced by preliminary research where pineapple milk powder has a vitamin C content of 8.92 mg / 100 g with a pineapple juice concentration of 20% while in the main study where pineapple milk powder has a vitamin C content of 12.90 mg / 100 g with a pineapple juice concentration of 30%. Meanwhile, the treatment of adding pectin concentration did not differ markedly in each different treatment. The addition of pectin cannot increase the content of vitamin C but vitamin C can be maintained because of the properties of pectin can absorb water so that there is less oxygen free in the juice which can cause vitamin C oxidation.

3.2.1.3 pH Value Using a pH meter

One of the characteristics that identifies a sample's level of acidity or alkalinity is its pH value.

Table 7. pH Value Yield Data Using pH Meter on Pineapple Milk Powder

Treatment	pH value
n1p1	4.59
n1p2	4.71
n1p3	4.63
n2p1	4,29
n2p2	4,13
n2p3	4,31
n3p1	4,11
n3p2	4,07
n3p3	4,01

Based on the calculation data, variations in the concentration of pineapple juice (N) and variations in pectin concentration (P), as well as the interaction between the two factors (NP) had a significant effect on the response of the pH value of pineapple milk powder where F calculated > F table so that in both variations further Duncan tests were carried out at the level of 5%.

The more addition of pineapple juice will cause a decrease in the pH value of pineapple milk powder as evidenced by preliminary research where the pH of pineapple juice is 3.83±0.03, the pH of milk is 6.56±0.08 and the pH of the mixture of milk and pineapple juice is 4.60±0.04.

The amount of pectin added also affects the pH level; the more the amount of pectin added, the lower the pH level in pineapple milk powder. The quantity of hydrogen ions present in a solution or product being examined is connected to the amount of acidity or pH. [12] pH measures acidity; the lower the pH number, the higher the acidity level. The occurrence of a decrease in pH with the increasing addition of pectin is suspected because pectin is acidic due to the presence of a carboxylic group. [13] Pectin will be hydrolyzed to produce pectic acid and pectinic acid. The higher the addition of pectin, the lower the pH. This is because pectin is hydrolyzed into pectic acid and pectinic acid during the production of pineapple milk powder, therefore the more pectin added, the more acid is produced and the pH decreases. Some of the carboxyl groups in pectin polymers, [14] are esterified by

methyl (methylation) into methoxyl groups. Meanwhile, the carboxyl group will be partially ionized releasing hydrogen atoms (H+) so that the pH decreases.

3.2.2 Physical Response Analysis Results

For the purpose to analyze physical responses, this research utilized a *Scanning Electron Microscope* (SEM), a Particle Size Analyzer (PSA), a water soluble time, solubility, hygroscopicity, color intensity, and a total yield calculation.

3.2.2.1 Water Soluble Time

Water is needed during the serving of powdered drinks as a solvent for consumption. As a result, water and powdered drinks are closely related. [15] The increased water content in meals will lead to bonds that form clots and make it take longer to dissolve the bindings between particles.

Based on the calculation data, the interaction between the two factors (NP) had no real effect on the response of water soluble time, while variations in the concentration of pineapple juice (N) and variations in pectin concentration (P) had a real effect on the response of soluble time in pineapple milk powder where F counted > F table so that in both variations further Duncan tests were carried out at the level of 5%.

Table 8. Data on the Results of Water Soluble Time in Pineapple Milk Powder

Treatment	Water Soluble Time (seconds)
n1p1	30,39
n1p2	31,60
n1p3	31,60
n2p1	34,00
n2p2	34,39
n2p3	34,81
n3p1	36,03
n3p2	36,81
n3p3	36,95

3.2.2.2 Solubility

The insoluble component of water is strongly related to the method of making powdered milk products. [8] Milk Powder, milk powder has an insoluble index that is not more than 1.0 mL.. The water-insoluble part is solids in foodstuffs that are insoluble in water.

Table 9. Solubility Yield Data on Pineapple Milk Powder

Treatment	Solubility (%)
n1p1	77,57
n1p2	77,59
n1p3	77,10
n2p1	77,24
n2p2	77,14
n2p3	77,15
n3p1	77,08

n3p2	76,86
n3p3	76,40

Based on the calculation data, the interaction between the two factors (NP) had no real effect on the solubility response, while variations in the concentration of pineapple juice (N) and variations in pectin concentration (P) had a significant effect on the response of soluble time in pineapple milk powder where F calculated > F table so that in both variations a Duncan further test was carried out at the level of 5%. Analyzing how easily pineapple milk powder dissolves in especially smallest modifications to pineapple juice concentration which has the largest solubility value of 77.57%.

3.2.2.3 Hygroscopicity

ygroscopicity is a characteristic that indicates a material's capacity to absorb moisture from the air around it and hold it in the spaces between its particles.

Table 10. Hygroscopicity Results Data on Pineapple Milk Powder

Treatment	Hygroscopicity (%)
n1p1	3,95
n1p2	3,50
n1p3	3,25
n2p1	2,90
n2p2	2,50
n2p3	2,20
n3p1	2,35
n3p2	2,15
n3p3	2,15

Based on the calculation data, variations in the concentration of pineapple juice (N) and variations in pectin concentration (P) had a significant influence on the hygroscopic response of pineapple milk powder where F calculated > F table so that in both variations further Duncan tests were carried out at the level of 5%.

There are several levels of hygroscopicity of materials according to the GEA Niro Research Laboratory, the level of hygroscopicity of < 10% is classified as non-hygroscopic materials, the level of hygroscopicity of 10.1-15% is classified into slightly hygroscopic materials, the level of hygroscopicity of 15.1-20% is classified as hygroscopic materials, the level of hygroscopicity of 20.1-25% is classified into highly hygroscopic materials, and the level of hygroscopicity of > 25% is classified into very hygroscopic materials. hygroscopic once (Widyasanti et al., 2018). In this study, pineapple milk powder was classified as a nonhygroscopic material because it had a value of 2-4%.

*3.2.2.4 Color Intensity-L*notation*

The L* notation expresses the lightness of instant powdered drinks. L* values range from 0 or black to 100 or white [17].

Table 11. L * Color Intensity Results Data on Pineapple Milk Powder

Treatment	Color Intensity L*

n1p1	55,21
n1p2	53,40
n1p3	50,19
n2p1	55,25
n2p2	53,34
n2p3	53,30
n3p1	49,99
n3p2	49,87
n3p3	49,12

Based on the calculation data, variations in the concentration of pineapple juice (N) and variations in pectin concentration (P), as well as the interaction between the two factors (NP) had a significant effect on the color intensity response of the value *L of pineapple milk powder where F counted > F table so that in both variations further Duncan tests were carried out at the level of 5%.

The brightness level of pineapple milk powder value *L close to 50 in all treatments resulted in a bright pineapple milk powder color. The results of the brightness intensity test of pineapple milk powder are suspected that the pigment content in the raw material has an effect on the brightness level. Pineapple fruit has bioactive compounds such as flavonoids [18]. The addition of pectin has a noticeable effect on the brightness of pineapple milk powder.

Pectin is a hydrolysate that has a white color [19]. As the concentration of pectin increases, which tends to be white when added in a mixture of pineapple milk, which is yellow, it gives a bright color, thus affecting the brightness level of the product.

- Notation a*

The combined red and green color is indicated by the symbol a*. While the value of a* ranges from -80 to 0 indicates green, the value of a* ranges from 0 to 80 indicates red [17].

Table 12. A * Color Intensity Results Data on Pineapple Milk Powder

Treatment	Color Intensity a*
n1p1	5,14
n1p2	5,63
n1p3	5,80
n2p1	6,16
n2p2	6,64
n2p3	6,87
n3p1	10,36
n3p2	11,46
n3p3	12,11

Based on the calculation data, the variation in the interaction between the two factors (NP) did not have a real effect on the color intensity response of the *a value, but the concentration of pineapple juice (N) and the variation in pectin concentration (P) had a real effect on the color intensity response of the value *a pineapple milk powder where F counted > F table so that in both variations a Duncan further test was carried out at a level of 5%.

The redness rate of pineapple milk powder ranges from 5.52 – 8.26. Pineapple fruit contains vitamin A of 130 IU [20]. The research of [21] tested the beta-carotene content of

the quuen variety pineapple fruit using a spectrophometric method of 11.72µg / g. This suggests that pineapple fruit contains orange red pigment carotene.

- Notation b*

The combination of blue and yellow is indicated by the symbol b*. b* has a value between 0 and 70 that can be shown as yellow, while nilai b* has a value between -70 and 0, which can be described in blue [17].

Table 13. Data on the Results of Color Intensity b* in Pineapple Milk Powder

Treatment	Color Intensity b*
n1p1	15,00
n1p2	17,74
n1p3	19,67
n2p1	17,74
n2p2	19,27
n2p3	20,52
n3p1	19,30
n3p2	20,32
n3p3	20,52

Based on the calculation data, variations in the concentration of pineapple juice (N) and variations in pectin concentration (P), as well as the interaction between the two factors (NP) had a significant effect on the color intensity response of the value *b of pineapple milk powder where

F counted > F table so that in both variations further Duncan tests were carried out at the level of 5%.

The degree of yellowness of pineapple milk powder ranges from 15-20.52. The higher concentration of pectin addition increases the color protection of the powder so that the color can be maintained [22]. Pineapple fruits contain a lot of carotenoid and xantophile pigments that give it a yellow color. Carotenoids have a yellow to red color, while xanthophylls have a yellow to orange color [23]. Pectin also affects the yellowness of pineapple milk powder. Pectin has the ability to stabilize emulsions and increase volatile retention of active substance components that contribute as pigments so that the protective qualities of pectin can prevent pigment degradation during the drying process.

3.2.2.5 Calculation of Total Yield

One of the important variables in the production of goods is yield. A comparison of yield is conducted between the quantity of the finished product and the quantity of the raw materials utilized. The greater the ultimate product value, the greater the overall yield calculation.

Table 14. Data on Total Yield Results in Pineapple Milk Powder

Treatment	Total Yield (%)
n1Pp1	10,32
n1p2	9,93
n1p3	10,38
n2p1	8,62
n2p2	8,81

n2p3	9,25
n3p1	7,77
n3p2	7,67
n3p3	7,78

Based on the calculation data, variations in pectin concentration (P) and the interaction between the two factors (NP) did not have a real effect on the yield response, but the concentration of pineapple juice (N) had a real effect on the response of pineapple milk powder yield where F calculated > F table so that in both variations a Duncan further test was carried out at a level of 5%.

The amount of water a material contains can have an effect on the yield that is produced. The yield may decrease as a result of the drying process developing a drop in the moisture content during processing [9]. Based on this, it appears that a material's water content may effect its weight, and that a material that has been dried will weigh less overall, which will have an impact on the finished product's overall yield.

3.2.2.6 Particle Size Analyzer (PSA)

The amount of the range of particle sizes of a sample might be identified with a particle size analyzer (PSA). A solid, suspension, or emulsion might be the sample that is used. Using the Dynamic Light Scattering procedure, analyze the particle size distribution of stable colloid/liquid samples or disseminated nanoparticle powders in liquid situations. The sample must be stable, indicating that it must not precipitate or react while being tested.

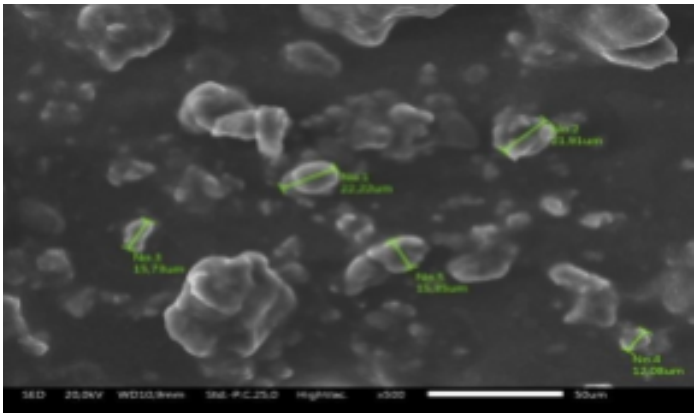

Fig.1. Particle Diameter Size with 500x Magnification

The results of the description of some samples using micron-scale PSA with 10% pineapple juice concentration and 0.1% pectin concentration in the range of 12.08-22.22m are shown in the figure above, so that the average is 17.15µm. [4] The procedure of crushing or dissolving the sample, as well as the procedure for drying, may have an effect on the size of the particle diameter of a powder. A powder's solubility increases and its dissolving time reduces with decreasing particle size.

3.2.2.7 Scanning Electron Microscopy (SEM)

The *Scanning Electron Microscopy* (SEM) instrument was utilized for morphological analyses of the pineapple milk powder drinks. The study examines the size and type of the particles in powdered beverages. The sample is formed up of pineapple milk powder drinks that first require a coating process to generate conductivity; this coating process makes use

of conductive elements, particularly Au or gold. [25] Argues that carbon (C) and platinum (Pt) are two other conductors that can be utilized. Using a sputtering instrument, samples may be coated with conductive compounds. The sample was then placed in a vacuum chamber for observing the structure of the drink produced with pineapple milk powder.

Based on the previously mentioned nanoencapsulation utilizing SEM data, it was shown that the pineapple milk powder drink sample had an unsteady aggregate form with a smooth surface. The pineapple milk powder drink sample had an unsteady and thorough form as a result of the nanoencapsulation procedure utilizing a SEM equipment.

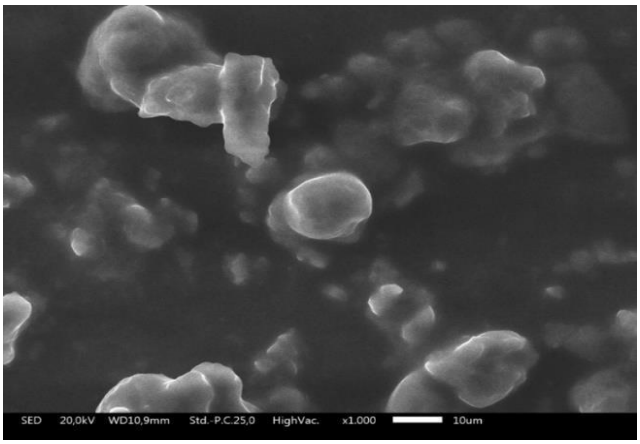

Fig.2. Nanoencapsulation Results with SEM with 1000x Magnification

3.2.3 Physical Response Analysis Results

The attributes of color, odor, taste, and aftertaste are considered organoleptic (hedonic) responses in this research.

3.2.3.1 Color Attributes

Table 15. Organoleptic Results of Pineapple Milk Powder Color Attributes

Treatment	Average Results
n1p1	6.00 pm
n1p2	6.15
n1p3	6.25
n2p1	6.43
n2p2	6.05
n2p3	5,33
n3p1	5,06
n3p2	5,00
n3p3	4,35

Based on the calculation data, variations in pectin concentration (P) and the interaction between the two factors (NP) had no real effect on the hedonic response of the pineapple milk powder color attribute, while the variation in the concentration of pineapple juice (N) had a real effect on the hedonic response of the pineapple milk powder color attribute

where F calculated the > F table so that in this variation a Duncan further test was carried out at the level of 5%.

In the n1 treatment, namely the concentration of pineapple juice of 10% had the highest average assessment by the panelists with a value of 6.43. The colors are expected to have a bright yellow color, for a significant standard value in the hedonic test experiments of the color attributes of each treatment. The increasing concentration of pineapple juice has a yellow-brown color, so the color of pineapple milk powder becomes a brownish color and is less liked by the panelists.

3.2.3.2 Aroma Attributes

Table 16. Organoleptic Results Attributes of Pineapple Milk Powder Aroma

Treatment	Average Results
n1p1	6,43
n1p2	6,05
n1p3	5,70
n2p1	5,65
n2p2	5,65
n2p3	5,48
n3p1	5,32
n3p2	5,35
n3p3	5,43

Based on the calculation data, variations in pectin concentration (P) and the interaction between the two factors (NP) did not have a real effect on the hedonic response of the pineapple milk powder aroma attribute, while the variation in the concentration of pineapple juice (N) had a significant effect on the hedonic response of the pineapple milk powder aroma attribute where F counted > F table so that in these variations a Duncan further test was carried out at a level of 5%.

In the n1 treatment, namely the concentration of pineapple juice of 10% had the highest average assessment by the panelists dengan value of 6.43. The scent is expected to have a distinctive pineapple scent, for a significant standard value in the hedonic test of the aroma attributes of each treatment. As the concentration of pineapple juice increases, it has a distinctive pineapple aroma that is too strong, so the aroma of pineapple milk powder becomes a distinctive pineapple aroma that is too strong and is less liked by the panelists.

3.2.3.3 Taste Attributes

Table 17. Organoleptic Results Taste Attributes of Pineapple Milk Powder

Treatment	Average Results
N1P1	5,17
n1p2	4,76
N1P3	4,32
n2p1	4,23
n2p2	4,62

n2p3	3,95
n3p1	3,65
n3p2	3,76
n3p3	3,47

Based on the calculation data, variations in pectin concentration (P) and the interaction between the two factors (NP) had no real effect on the hedonic response of the pineapple milk powder color attribute, while the variation in the concentration of pineapple juice (N) had a real effect on the hedonic response of the pineapple milk powder color attribute where F calculated the > F table so that in this variation a Duncan further test was carried out at the level of 5%.

In the n1 treatment, namely the concentration of pineapple juice of 10% had the highest average assessment by the panelists with a value of 5.17. The taste is expected to have a distinctive taste of pineapple milk, for a significant standard value in the hedonic test of the taste attributes of each treatment. Increasingly, the concentration of pineapple juice has a strong characteristic taste of pineapple milk, so the taste of pineapple milk powder becomes a strong characteristic taste of pineapple milk and is less liked by the panelists.

3.2.3.4 *After Taste* Attribute

Table 18. Organoleptic Results Attributes *After Taste* Pineapple Milk Powder

Treatment	Average Results
n1p1	5,27
n1p2	4,73
n1p3	4,50
n2p1	4,20
n2p2	4,33
n2p3	3,85
n3p1	3,72
n3p2	3,72
n3p3	3,82

Based on the calculation data, the interaction between the two factors (NP) had no real effect on the hedonic response of the after-taste attribute of pineapple milk powder, while the variation in the concentration of pineapple juice (N) and the variation in pectin concentration (P) had a real effect on the hedonic response of the *after-taste* attribute of pineapple milk powder where F calculated > F table so that in this variation a Duncan further test was carried out at a level of 5%.

In the n1 treatment, namely the concentration of pineapple juice of 10% had the highest average assessment by the panelists with indigoi 5.27. *After* taste is expected to have a distinctive after taste of pineapple milk, for a significant standard value in the hedonic test experiment of the *after taste* d attribute of each treatment. As the concentration of pineapple juice increases, it has a strong *aftertaste* of pineapple milk, so that the after taste of pineapple milk powder becomes the typical *after taste* of pineapple milk which is bitter and less liked by the panelists.

4 Conclusion

All chemical, physical, and organoleptic responses of pineapple milk powder are affected on the concentration of pineapple juice (N). Water content, pH level, water dissolving time in water, solubility, color intensity, and organoleptic responses to the aftertaste properties of pineapple milk powder are all determined by pectin concentration (P). The water content, vitamin C content, color intensity of *L and *b values of pineapple milk powder are all affected by the interaction between the levels of nanas juice (N) and pectin (P). The samples selected were n1p1 with 10% pineapple juice concentration, 1% pectin concentration, and 2.40% moisture content. vitamin C content of 4.93%, pH value of 4.59, water dissolving time of 30.39 seconds, solubility of 77.57%, hygroscopicity of 3.95%, color intensity *L of 55.21, color intensity *a of 5.14, color intensity *b of 15.00 and total yield of 10.32%.

5 Suggestion

A need conducted further research on the influence of temperature and the duration of drying, because the heating process greatly affects the nutritional value of this pineapple milk powder product. It is necessary to conduct research on the differences in drying methods such as using *freeze drying* so that the content of active compounds and nutrients can be better maintained.

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