SENSORY PROPERTIES AND PHYSICAL PROPERTIES AND MICROSTRUCTURE APPEARANCE OF YOGURT WITH THE ADDITION OF WHITE OYSTER MUSHROOM *(Pleurotus ostreatus)* JUICE

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Abstract

The purpose of this study was to analyze the sensory properties and physical properties of yogurt as well as the appearance of yogurt microstructure with the addition of white oyster mushroom juice (Pleurotus ostreatus). This study used a Complete Randomized Design with 5 treatments consisting of concentrations of 0%, 2%, 4%, 6%, 8% white oyster mushroom juice added to yogurt and repeated 4 times. The results of the fingerprint analysis showed that the addition of white oyster mushroom juice (Pleurotus ostreatus) to a concentration of 8% gave a very noticeable difference (P≤0.01] to sensory properties which included texture, taste, aroma, color and physical properties consisting of syneresis and viscosity of yogurt. Values for textures range from 3.20 to 4.60, values for colors range from 4.33 to 4.40, scores for aromas range from 4.27 to 4.40, values for flavors range from 3.60 to 4.53 from the highest score rating with a score of 5. For viscosity values ranging from 774.75 to 886.25 and syneresis values range from 57.24 to 52.28. The appearance of the microstructure indicates an increasingly compact bond with increasing concentration of the juice of the white oyster mushroom (Pleurotus ostreatus). The conclusion of this study the higher the concentration of white oyster mushroom juice gave good results on sensory properties and physical properties as well as the appearance of an increasingly compact microstructure.

Key words : *Natural Stabilizer, β-glukan, Dietary fiber*

INTRODUCTION

Yogurt fermented milk has a composition of high nutritional value, good taste, also has certain physiological functions for the human body, so it is called a functional food ingredient (Anis and Radiati, 2018). Efforts to improve the quality of yogurt can be carried out through engineering efforts in the manufacturing process, namely by adding natural stabilizing agents, modifying the composition of milk, type of stater, incubation time and storage time (Kaur and Riar, 2020).

The addition of stabilizers to yogurt serves to overcome the problem of syneresis, improve gel properties, viscosity, smoothness of texture and appearance of microstructure, sensory properties, so as not to cause rejection from consumers of fermented milk products (Arioui et al., 2017).

Research related to stabilizers in fermented milk products still uses chemical or synthetic stabilizers, therefore it is necessary to study the use of natural stabilizers that have an important impact on consumer health, for example the use of white oyster mushroom juice (*Pleurotus ostreatus*) as a natural stabilizer (Lisko et al., 2017).

White oyster mushroom (*Pleurotus ostreatus*) is a food commodity with high nutritional value, contains compounds β-glucan, is a group of dietary fiber that has advantages in the health sector, including increasing endurance, preventing cholesterol, hypertension, diabetes, obesity, bowel cancer.

Fiber β-glucan contained in the juice of white oyster mushrooms (*Pleurotus ostreatus*) can act as a prebiotic because it can increase the viability of lactic acid bacteria (Aniss and Radiati, 2018).

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The content of β-glucan in the juice of white oyster mushrooms (*Pleurotus ostreatus*) can be a natural stabilizing ingredient that provides health benefits for fermented beverages such as yogurt so that it can be an alternative choice of cheap natural stabilizing ingredients compared to other stabilizers and has no toxicity or adverse effects on consumer health (Skryplone et al., 2019).

Based on the description above, a research study is needed to identify microstructure, sensory properties, syneresis, viscosity of yogurt with the addition of white oyster mushroom juice (*Pleurotus ostreatus*).

This study aims to analyze the appearance of microstructure, sensory properties, syneresis, viscosity of yogurt with the addition of white oyster mushroom juice (*Pleurotus ostreatus*).

MATERIAL AND METHOD

This research was carried out in June 2022 at the Livestock Product Technology laboratory of the Faculty of Animal Husbandry, Universitas Brawijaya Malang for sample preparation, and the process of making yogurt with the Addition of white oyster mushroom (*Pleurotus ostreatus*) juice. The appearance of microstructure, sensory properties, syneresis, viscosity Analysis of yogurt at the Labaratorium of Food Science, Faculty of Agricultural Technology, Universitas Brawijaya Malang.

Materials

The materials used in this study are: white oyster mushroom juice, fresh milk, Tools used include: plastic containers, refrigerator, thermometer, pH meters, ethanol 40%, aquades, alcohol, starter culture.

Methods

Making white oyster mushroom juice

White oyster mushrooms cleaned and washed then weighed 500g after which they are cut and extracted with 500ml of aquabidest homogenized for 10 minutes using a blender and pasteurized until they reach 75ºC and maintained for 30 minutes after which they are cooled to a temperature of 45ºC and filtered using a filter cloth.

Making Yogurt

Fresh cow's milk of 470ml was added to the white oyster mushroom juice according to the treatment with a concentration of 0%, 2%, 4%, 6%, 8% pasteurized for 15 minutes at a temperature of 85ºC and cooled to a temperature of 45ºC then added starter as much as 3% and incubated for 18 hours at a temperature of 27ºC.

Sensory Testing

Includes testing of texture, color, aroma, taste, yogurt with the addition of white oyster mushroom juice (*Pleurotus ostreatus*) carried out on a hedonic scale using 35 panelists. The hedonic scale is made five levels [score 1-5], for texture testing it starts from 1 [very not smooth], 2 [not smooth], 3 [slightly smooth], 4 [smooth], 5 [very smooth]. Color testing starts from 1 [deviant], 2 [yellowish-white], 3 [slightly white], 4 [white], 5 [very white]. Aroma testing 1 [very not typical of yogurt), 2 [not typical of yogurt], 3 [somewhat typical of yogurt], 4 [typical of yogurt], 5 [very typical of yogurt]. Taste testing starts from 1 [very sour taste], 2 [sour taste], 3 [medium sourness], 4 [slightly sour taste], 5 [slightly sour taste].

Syneresis testing

Syneresis testing according to (Han, et al., 2016) weighed the setrifus tube, inserted the sample into the setrifus tube, centrifuged at a speed of 1523 rpm for 10 minutes at 4^0C, separated the whey liquid from the yogurt precipitate then calculated the syneresis.

$$\text{Syneresis} = \frac{A-B}{A} \times 100$$

A = Starting Weight [G] B = Final weight

Viscosity testing

Viscosity testing using Brooke Field Viscometer tool (AOAC, 2010). Preparing a sample to be measured viscosity in a beaker of 100 ml. filling the liquid sample is almost close to full, so that the spindle used to measure the liquid is entirely immersed in the liquid. Preparing a Brookfield Viscometer along with a spindle. The sample of the liquid measured in viscosity is yogurt liquid, so it requires spindle no 6 and spindle rotation

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speed set at 20. Heating a yogurt sample to 55ºC, using a thermometer to measure its temperature. upon reaching a temperature of 55ºC, lift the sample and place in the viscometer. Dip the spindle into the sample and press the on button to start the measurement. Reading viscosity measurement by looking at the position of the red needle, to see the position of the red needle this must be in a stable condition. when the red needle shows a fluctuating number it means that the measurement is not stable.

Viscosity = measurement numbers x Factor
Viskositas Sample = measurement numbers x 1.000 mPaS
Note : factors derived from the table listed in the viscometer tool

Testing the Appearance of Yogurt Microstructure

The tools used in this test were FSX 100 flurescence microscopes, test tubes, glass covers and object glass, while the materials used in this study were yogurt and rhodamine B samples. The testing process is as follows adding 0.015 grams of rhodamin B to 10 ml of aquades, menstirer to homogeneous, preparing a yogurt sample of 5 ml, mixing a yogurt sample with 100 µL of rhodamin B into a test tube, taking with a micropipette 100 µL- 200 µL as much as 10 µL of yogurt sample, grinding on an object glass and covered with a glass cover, allowing it to stand for 10 minutes, observed with a fluorescence microscope FSX 100 (Raikos, 2018).

Data Analysis

This study was conducted with laboratory experiments with a Complete Randomized Design with 5treatments [0%, 2%, 4%, 6%, 8%] and 4 repeats. All data were analyszed for variance [ANOVA] and continued with the smallest real difference test [LSD] using SPSS 16.0 (Subali, 2010).

RESULTS AND DISCUSSIONS

Organoleptic Properties of Yogurt With the Addition of White Oyster Mushroom Juice (*Pleurotus ostreatus*)

Data on the results of the organoleptic properties of yogurt with the addition of white oyster mushroom juice (*Pleurotus ostreatus*) can be seen in Table 1.

Table 1. Average Value of Organoleptic Properties of Yogurt With the Addition of White Oyster Mushroom Juice (*Pleurotus ostreatus*)

Treatment (%)	Texture	Color	Aroma	Taste
0	3.20 ± 0.14^{ab}	4.33 ± 0.49^{a}	4.27 ± 0.59^{c}	3.60 ± 0.63^{a}
2	3.20 ± 0.46^{ab}	4.07 ± 0.46^{b}	4.13 ± 0.52^{a}	3.39 ± 0.70^{b}
4	3.80 ± 0.14^{c}	4.20 ± 0.41^{c}	4.20 ± 0.41^{ab}	4.33 ± 0.46^{c}
6	4.07 ± 0.59^{d}	4.40 ± 0.51^{de}	4.47 ± 0.52^{e}	4.47 ± 0.52^{de}
8	4.60 ± 0.63^{e}	4.40 ± 0.51^{de}	4.40 ± 0.51^{d}	4.53 ± 0.52^{de}

Description:Different notations show very noticeable differences between treatments [P≤0.01]

Texture Value of Yogurt with the Addition of White Oyster Mushroom Juice (*Pleurotus ostreatus*)

Based on the results of the variety analysis showed the addition of white oyster mushroom juice (*Pleurotus ostreatus*) gives a very noticeable difference [P≤0.01] to the texture of yogurt. Difference this is due to the addition of white oyster mushroom juice (*Pleurotus ostreatus*) containing Carbohydrate components, namely dietary fiber, β-glucan, which are able to bind to milk proteins thus producing a compact and stable structure (Basiri et al., 2018). Factors affecting texture yogurt is a bond of aggregation of casein micelles with the help of acids so that a gel is formed that compact and smooth.

The assessment from the panelists for yogurt texture with the addition of white oyster mushroom juice (8%] gave the highest value while the lowest value was on without the addition of white oyster mushroom essence [0%] and the addition of oyster mushroom essence [2%]. Values for textures range from 3.20 to 4.60 from the highest rating with a value of 5.

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Yogurt Color Value with the Addition of White Oyster Mushroom Juice (*Pleurotus ostreatus*)

Based on the results of the variety analysis, it shows that the addition of white oyster mushroom juice (Pleurotus ostreatus) gives a very noticeable difference [P≤0.01] to the color of yogurt. This is because the addition of white oyster mushroom juice has an effect on discoloration in yogurt. White oyster mushroom juice is slightly brown in color so that the higher the concentration of white oyster mushroom juice has an influence on the color of yogurt. Values for colors range from 4.33 to 4.40 from the highest rating with a value of 5. The panelists' highest rating of yogurt color on the addition of white oyster mushroom juice concentrations of 6% and 8%.

According to the opinion of Sakul., *dkk* [2020] states that the higher the concentration of stabilizing agents the more the sensory value for color is compared to not using stabilizing agents.

Aroma Value of Yogurt with the Addition of White Oyster Mushroom Juice (*Pleurotus ostreatus*)

Based on the results of the variety analysis, it shows that the addition of white oyster mushroom juice *(Pleurotus ostreatus)* has a significantly different influence [P≤0.01] on the aroma of yogurt. This can be caused because the higher the concentration of white oyster mushroom juice gives a distinctive aroma so that the characteristic smell of yogurt disappears. Scores for scents ranged from 4.27 to 4.40 from the highest rating with a score of 5. The panelists' level of assessment was influenced by the appearance of yogurt from other aromas. The highest yogurt aroma assessment on the addition of 8% white oyster mushroom juice concentration resulted in a specific aroma that was influenced by the concentration of white oyster mushroom juice produced by carbonyl compounds during the fermentation process by lactic acid bacteria.

White oyster mushroom juice is able to degrade the distinctive aroma of yogurt because it contains dietary fiber which during the fermentation process is able to provide food for lactic acid bacteria. During the fermentation process, milk lactose and dietary fiber contained in the juice of white oyster mushrooms are degraded by lactic acid bacteria to produce a specific yogurt aroma (Argawal, 2013).

Taste Value of Yogurt with the Addition of White Oyster Mushroom Juice (*Pleurotus ostreatus*)

Sensory value for taste with the addition of white oyster mushroom juice *(Pleurotus ostreatus)* exerts a markedly different influence [P≤0.01] on the taste of yogurt. This is because the addition of white oyster mushroom juice *(Pleurotus ostreatus)* has an influence on the taste of yogurt that is not too sour. Scores for taste range from 3.60 to 4.53 from the highest scoring score of 5. In the process of cheese processing, the significantly lost moisture content can affect the weight loss during the ripening period. Added salt can also affect the loss of moisture in cottage cheese. The sour taste in yogurt is influenced by the metabolic activity of lactic acid bacteria in the fermentation process degrading milk lactose to lactic acid.

Average Viscosity and Syneresis of Yogurt With the Addition of White Oyster Mushroom Juice (*Pleurotus ostreatus*)

Data on viscosity and syneresis of yogurt with the addition of white oyster mushroom juice (*Pleurotus ostreatus*) can be seen in Table 2.

Table 2. Average Value Viscosity and Syneresis of Yogurt With the Addition of White Oyster Mushroom Juice (*Pleurotus ostreatus*)

Treatment [%]	Viscosity [%]	Syneresis [%]
0	774.75±10.78	57.24±0.41
2	851.50±18.52	55.38±1.42
4	877.00±5.48	53.19±1.19
6	878.75±5.62	52.96±0.85
8	886.25±6.99	52.28±2.52

Description: Different notations show very noticeable differences beetwen treatments [P≤0.01]

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Viscosity of Yogurt with the Addition of White Oyster Mushroom Juice (*Pleurotus ostreatus*)

The results of the variety analysis showed the addition of white oyster mushroom juice (*Pleurotus ostreatus*) exerts a markedly different influence [P≤0.01] on the average of the viscosity numbers between treatment of the addition of white oyster mushroom juice (*Pleurotus ostreatus*). The addition of white oyster mushroom juice (8%) produced the highest viscosity, due to the White oyster mushroom juice contains β-glucan as a producer of polysaccharides. White oyster mushroom contains bioactive molecules, namely polysaccharides, terpenoids, phenolics, lectins, statins, the presence of Polysaccharides in white oyster mushrooms can be utilized as natural stabilizers capable of binding water (Permadi et al., 2021).

Yogurt Sineresis with the Addition of White Oyster Mushroom Juice (*Pleurotus ostreatus*)

The results of the variance analysis showed that there was a noticeable difference [P≤0.01] against average syneresis rate between treatments of white oyster mushroom juice (*Pleurotus ostreatus*). Yogurt with the addition of white oyster mushroom juice (Pleurotus ostreatus) as much as 8% has the lowest syneresis value, The results of this study show that the process syneresis can be reduced, this is due to the fact that white oyster mushroom juice can act as natural stabilizing compounds. White oyster mushroom juice can be a natural stabilizing agent because it can increases the binding power of water and lowers syneresis (Sakul, *dkk.* 2020). The higher the concentration of oyster mushroom juice White *(Pleurotus ostreatus)* the lower the syneresis produced this is due to the White oyster mushroom juice has the ability to bind water by increasing the hydrophilic properties of proteins. Syneresis is a problem that often occurs in the process of making yogurt, syneresis caused by the detachment of whey from the yogurt body. Influencing factors yogurt syneresis is pH, total acid and water binding power (Harjiyanti et al., 2021).

Effect of White Oyster Mushroom Juice Concentration (*Pleurotus ostreatus*) On Appearance of Yogurt Microstructure

Profile Microstructure

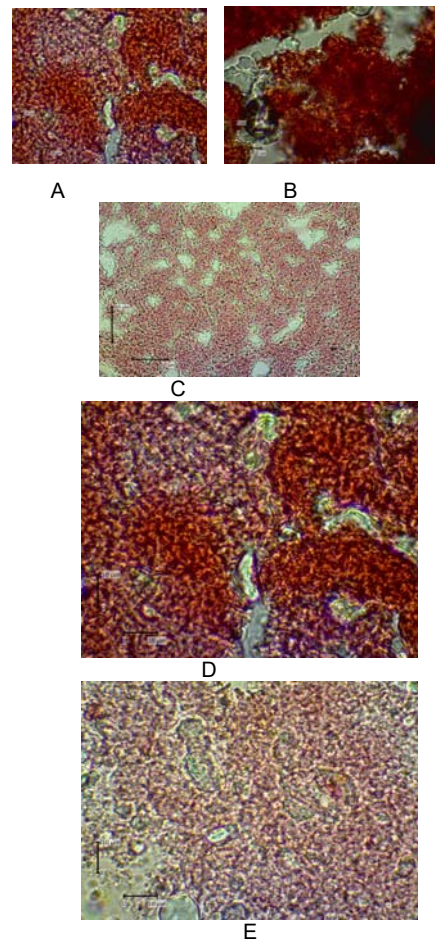

Fig 1. Yogurt microstruktur CLSM Method enlargement 100 x. A. [0%] oyster mushroom juice White, B. [2%] oyster mushroom juice White, C. [4%] oyster mushroom juice White, D.[6%] oyster mushroom juice White, E. [8%] oyster mushroom juice White

The appearance of the yogurt microstructure based on the addition of the concentration of oyster mushroom juice White (*Pleurotus ostreatus*) using the CLSM method can be seen in Figure 1.

The appearance of the yogurt microstructure with the addition of white

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oyster mushroom juice (*Pleurotus ostreatus*) as a stabilizing agent (Figure 1) shows the interaction between fungal juices white oysters and casein. Dietary fiber components are β-glucan contained in mushrooms White oysters (*Pleurotus ostreatus*) affect the protein matrix resulting in a gel compact yogurt. Rhodamin dye on the observation of microstructures serves as a binder to proteins, therefore, the red clot describes a protein matrix in the form of an aggregate and dietary fiber appears as dark clots embedded in the protein matrix. The interaction of casein with various concentrations of oyster mushroom juice white (*Pleurotus ostreatus*) can be seen in Figure 1. [A, B, C, D, E].

CONCLUSIONS

The conclusion of this study the higher the concentration of white oyster mushroom juice gave good results on sensory properties and physical properties as well as the appearance of an increasingly compact microstructure.

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