



**Research Article**

## Viscosity and organoleptic test of gude bean soy sauce (*Cajanus cajan* L.)

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### ABSTRACT

Gude nuts are known as wooden nuts on Kisar Island, which is an area that uses wood nuts as food. This study aims to determine the viscosity value and organoleptic test of pigeon pea sauce based on the weight of the beans. This research was conducted in February – March 2021 at the Laboratory of the Biology Education Study Program, Pattimura University, Ambon and a viscosity test at the Ambon Industrial Standardization and Research Institute (Baristand) using an experimental research type and the research design used was a completely randomized design (RAL), using 3 treatments, namely the weight of pigeon pea 150 g, 300 g and 450 g and using 2 replications to obtain 6 samples. This study showed that the weight of pigeon pea had an effect on the viscosity and organoleptic of soy sauce. From the viscosity analysis, the highest viscosity was obtained, namely 608.065 cp with a weight of 450 g pigeon pea, while for pigeon pea 300 g 411.065 cp and 150 g gude beans at 141 cp and organoleptic test obtained the average value of the texture of soy sauce on the treatment of pigeon pea and soy sauce 450 g pigeon pea 300 g with an average value of 4 (very thick) and peanut gude 150 g with an average value of 3 (thick). In the flavor of pigeon pea sauce 300 g and 150 g have an average value of 3 (fragrant), while for the treatment of 450 g peanuts is 4 (very fragrant). The color of the soy sauce in the pigeon pea sauce treatment was 450 g and 300 g with an average value of 4 (very black), and the 150 g peanut sauce treatment was 3 (black). In the treatment of 450 g of pigeon pea sauce and 300 g of pigeon pea sauce, the average value was 3 (sweet). For 150 g of pigeon pea soy sauce, on average the panelists gave a score of 2 (less sweet). There is an influence on the viscosity because the weight of the nuts used is different. while the organoleptic test showed a thick, fragrant, less sweet, and sweet taste.

**Keywords:** *Cajanus cajan* L. soy sauce, viscosity, organoleptic.

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### Introduction

Indonesia has various types of nuts that can grow well. Some local beans can be found in remote areas and used for food needs. Nuts have been planted in Indonesia for hundreds of years. This plant consists of various types, such as soybeans, green beans, peanuts, and various types of vegetable beans such as winged beans, peas, long beans and green beans (Primiani & Pujiati, 2016). Based on the nuts that exist in Indonesia, one of the nuts that is

interesting to study is the gude bean (*Cajanus cajan* L.). Gude bean is an annual plant and has advantages over other local legumes, including drought tolerance, resistance to fall and the pods are not easy to break, but are sensitive to pod destroying pests, require a lot of sunlight and cannot tolerate humid conditions (Mas'ud et al. 1993). Gude beans have good nutrition, tolerant of environmental stress, high biomass production which can be used to improve nutrient availability and soil moisture (Maintang et al, 2014). Gude nuts are known as wooden nuts on Kisar Island, which is an area that uses wood nuts as food ingredients. Practically, the people of Kisar Island plant this wood bean as a fence which is planted together with other secondary crops such as corn. Empirically, the people of Kisar Island use these wood nuts as food, both young and old wood nuts can be boiled together with corn and can also be used as compote (Eclesia danisa, 2020). Every 100 g of gude beans generally contains 336 kcal of energy, 20.7 g of protein, 62 g of carbohydrates, 1.4 g of fat, 12.2 g of water content (Dewi, 2010). Gude bean seeds consist of 85% cotyledons, 14% seed coat and about 1% embryo and contain a variety of dietary nutrients (Saxena et al, 2010).

Soy sauce in the community is generally made from soybeans. Soybean as a raw material for making soy sauce is currently experiencing an increase in prices, causing an imbalance in meeting vegetable protein. Soy sauce is a liquid resulting from the fermentation of high protein vegetable or animal ingredients in a salt solution. Soy sauce is usually consumed with the staple food of rice, vegetables, meat, poultry, and fish (Meilly Kusumadewi, 2011). One of the efforts to reduce dependence on soybeans in making soy sauce, and the price is still affordable by all levels of society, then there must be another alternative, namely by using gude beans to make soy sauce. For this reason, it is necessary to test the viscosity on peanut sauce, which is a characteristic characteristic of sweet soy sauce and this is related to its quality. Sweet soy sauce that is watery or has a low level of viscosity is said to be of poor quality. Viscosity is an important parameter in soy sauce products, because it can be used as a control or processing control (Erliani Ginting et al, 2014). The tool used in the viscosity test is a viscometer which functions to measure the viscosity of a liquid (Wanta widiantara et al, 2018).

Organoleptic testing has an important role in the application of quality, because it can provide an indication of spoilage, quality deterioration, and other damage to the product. Organoleptic test is an assessment method using only the human senses. Organoleptic assessment is the most widely used method because it is easier and faster to do, does not require a lot of equipment and the results of measurements and observations are also quickly obtained. The organoleptic test concerns the taste, aroma, texture and color of food and beverages that will be assessed by the panelists. (Harni Sepriyani & Rosa Devitria 2018). The purpose of this study was to determine the viscosity and organolepticity of gude (*Cajanus cajan* L.) soy sauce based on the weight of the beans.

## METHODS

This type of research is experimental, namely research that is used to determine the effect of the independent variable on the dependent variable under controlled conditions. In order for conditions to be controlled, experimental research uses a control group and is carried out in a laboratory. This research was carried out in the basic biology laboratory of the Biology Education Program, Pattimura University, Ambon on 20 February – 21 March 2021.

### Treatment procedure

#### 1. Sorting.

Samples were prepared, old pods were weighed as much as 3 g. Furthermore, the gude bean seeds are separated from the pods by pressing until the pods are broken after separating the seeds from the pods then separated by color and dried using a fan for 3 to 4 days. After the beans are dry, the separation between the wrinkled and good beans is carried out again, the old beans are weighed as much as 900 g using an analog scale.

#### 2. Washing

Prepare the tools that will be used for sterilization. Weigh the beans as much as 150 g, 300 g and 450 g. Put the beans in a bowl and wash them using running water. Prepare 3 sterilized aluminum basins then add nuts in a 1:3 ratio. The beans are soaked and then covered with aluminum foil for 22 hours.

#### 3. Boiling

The results of the immersion were drained using an aluminum filter and then washed with aqua water 3 times. Prepare 3 stoves and 3 pots. Add water in a ratio of 1:8. Put the beans at the same time into the boiling water and keep the temperature at 70<sup>0</sup> C, then wait until the texture of the beans softens. Drain the beans using an aluminum sieve until no water remains.

#### 4. Mushrooming

Prepare a tray lined with a napkin, then pour the nuts on top. Dry using a tissue until completely dry. Weigh the fungus *Aspergillus sojae* using an analytical balance as much as 0.3% (0.45 g, 0.90 g, and 1.35 g). Sprinkle the mushrooms according to the weight of the beans then stir gently using a spoon until the mushrooms are evenly distributed. Cover each tray with coffee paper for 2 days.

#### 5. Salting

Weigh the coarse salt using a digital scale as much as 20% and adjusted for the weight of the beans. Dissolve the salt with water in an Erlenmeyer flask. Pour the nuts into each jar, then add the salt solution to it. Incubation at 28<sup>o</sup> C-30<sup>o</sup> C for 30 days.

#### 6. Cooking

The results of fermentation are filtered through a filter, the dregs are removed and the filtrate is used. The filtrate was cooked with 15 g of lemongrass seasoning, 550 g of brown sugar, 1 g of bay leaf, 1 g of lime leaves, 20 g of galangal, 5 g of kluwak, and 1 g of star anise. The mixture was cooked for 1 hour at 70<sup>o</sup>C and stirred with a wooden stirrer clockwise until thickened and not foamy. Next, it is filtered using a filter.

#### 7. Bottling

Bottling using a clean bottle, then the soy sauce liquid is put into the bottle and tightly closed, after that the sample is ready to be tested for viscosity and the level of public preference.

#### 8. Viscosity test

Viscosity is a statement of the resistance of a liquid to flow. The unit of viscosity is the poise (1 poise = 100 cP). The higher the viscosity, the greater the resistance of the liquid in question. Carrageenan solution with a concentration of 1.5% is heated in a boiling water bath while stirring regularly until the temperature reaches 75<sup>o</sup>C. Viscosity was measured with a Brookfiel Viscometer.

#### 9. Organoleptic test

The data collected for the physical quality variable of soy sauce includes 4 parameters, namely color, texture, aroma and taste of soy sauce. The data collected for each parameter is score data obtained from 15 panelists based on soy sauce organoleptic criteria.

### Data analysis

The data obtained from this study were analyzed using SPSS 20, namely one-way ANOVA analysis. If it shows significant results, it is continued with the LSD (Least Significance Different).

## RESULTS AND DISCUSSION

**Table 1.** Results of soy sauce viscosity test

sample code	Total (centipoise)	Average
A1	153, 62 cP	141 cP
A2	128, 38 cP	
B1	420, 38 cP	411, 065 cP
B2	401, 75 cP	
C1	586,25 cP	608,065 cP
C2	629,88 cP	

Information :

A : gude peanuts 150

B : gude peanuts 300 g

C : gude peanuts 450 g

Based on the test results in Table 1, it shows that the viscosity test results for peanut gude sauce on each sample based on the weight of the beans, namely gude beans 150 g, gude beans 300 g, and gude beans 450 g were different. The highest viscosity was 608.065 cp with a weight of 450 g gude nuts, while for gude beans 300 g 411.065 cp and 150 g gude nuts were 141 cp and was the lowest viscosity.

**Table 2.** Anova test of soy sauce viscosity

Viscosity	Sum of Squares	Mean Square	F	Sig.
Between Groups	219929.212	109964.606	228.481	0.001

Within Groups	1443.856	481.285
Total	221373.068	

The results of the ANOVA test in table 2 show that there is a significant difference in the viscosity of peanut gude soy sauce (0.001). therefore continued with the Least Significance Different (LSD) test.

**Table 3.** Viscosity test LSD .

(I) dosis	(J) dosis	Mean Difference (I-J)	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
150 grams	300 g	-270.06500*	.001	-339.8822	-200.2478
	450 g	-467.06500*	.000	-536.8822	-397.2478
300 grams	150 g	270.06500*	.001	200.2478	339.8822
	450 g	-197.00000*	.003	-266.8172	-127.1828

The results of this study showed that the viscosity test of Kacang gude based on the weight of the beans showed significant differences at the doses of 150 g, 300 g and 450 g. Viscosity test based on the weight of peanuts showed that the more peanuts used, namely 450 g, the higher the viscosity of soy sauce by 608.065 cP, while for gude beans 300 g had a viscosity value of 411.065 cP, and the lowest viscosity in 150 g gude beans was 141 cP. This is because the carbohydrate and protein content in every 100 g of gude beans generally contains 62.78 g carbohydrates and 21.69 g protein (Lim, 2012). This happens because the protein is a reversal or folding process that occurs in the layer of protein molecules, especially when the protein solution has approached the isoelectric pH, and eventually the protein will agglomerate and precipitate. This clumping and deposition causes the viscosity to increase (Khodijah, 2003). As for carbohydrates, the viscosity will be high in the process of making soy sauce, namely carbohydrates from beans are broken down into simple sugars through a fermentation process. During the koji fermentation process, carbohydrates are broken down into simpler bonds, namely glucose and the breakdown of other chemical components becomes simpler (Budi Santoso et al, 2018). According to Nugraheni (2013), the thickness of sweet soy sauce is also influenced by the processing (cooking) process to reach a certain level of viscosity. In terms of the cooking time, the difficulty faced is to accurately estimate when the cooking process stops in relation to the estimated viscosity that has been achieved. The viscosity (thickness) that occurs is also due to the addition of brown sugar which causes the formation of a gel because the sugar is mixed with the gude nut filtrate, a melting process occurs.

**Table 4.** Organoleptic test results of gude peanut soy sauce 150 grams

No	Panelist	Soy sauce texture	Smell of soy sauce	soy sauce color	Soy sauce taste
1	SK	3	3	4	2
2	YR	4	4	3	3
3	AR	3	3	4	2
4	YD	3	3	3	2
5	AR	4	3	3	3
6	RK	2	4	4	2
7	DS	4	4	4	3
8	SS	3	3	3	2
9	SD	4	4	3	3
10	RD	3	3	3	2
11	RT	2	3	3	3
12	EE	3	3	3	2
13	RHY	3	3	3	3
14	ET	4	3	3	2
15	HK	3	3	3	2
Total		48	49	48	36
Average		3	3	3	2

Based on the results of the preference test in Table 4, Peanut gude soy sauce 150 g has an average value of 3 (thick) for the texture of the soy sauce, while the aroma of soy sauce gets an average value of 3 (fragrant), and an average value of 3 (black) on the color of the soy sauce. , and for the soy sauce taste, the 150 g of peanut gude soy sauce has a lower value than the 300 g and 450 g of peanut gude, namely 2 (less sweet) for the soy sauce taste.

**Table 5.** Organoleptic test results of peanut gude soy sauce 300 grams

No	panelist	Soy sauce texture	Smell of soy sauce	Soy sauce color	Soy sauce taste
1	SK	4	3	4	3
2	YR	4	4	4	3
3	AR	3	4	3	2
4	YD	4	3	4	4
5	AR	3	4	4	3
6	RK	4	4	3	4
7	DS	3	3	4	3
8	SS	3	3	3	2
9	SD	3	3	3	4
10	RD	4	3	4	3
11	RT	3	3	4	4
12	EE	4	3	4	2
13	RHY	3	4	3	3
14	ET	4	3	3	4
15	HK	3	4	3	4
Total		52	51	53	48
Average		4	3	4	3

Based on the results of the preference test in table 5, peanut gude sauce 300 g gets an average value of 4 (very thick) for the texture of soy sauce, while the aroma of soy sauce has an average value of 3 (fragrant), and a value of 4 (very black) on the color of the soy sauce, and an average value of 3 (sweet) for the taste of soy sauce.

**Table 6.** Organoleptic test results of gude peanut soy sauce 450 g

No	Panelist	Soy sauce texture	Smell of soy sauce	soy sauce color	Soy sauce taste
1	SK	4	4	4	4
2	YR	4	4	3	3
3	AR	4	4	4	3
4	YD	3	3	4	4
5	AR	4	3	4	3
6	RK	3	4	4	3
7	DS	4	4	3	4
8	SS	3	3	4	3
9	SD	4	4	4	4
10	RD	3	3	4	3
11	RT	4	4	3	4
12	EE	3	3	3	4
13	RHY	4	3	3	3
14	ET	3	3	4	4
15	HK	4	3	4	4
Total		54	54	52	55
Average		4	3	4	3

Based on the results of the preference test in Table 6, peanut sauce gude 450 g has an average value of 4 (very thick) for the texture of soy sauce, while the aroma of soy sauce has an average value of 3 (fragrant), and the average value of soy sauce color gets an average value. the highest average was 4 (very black) of 150 g peanut sauce and 300 g peanut sauce, and the average value was 3 (sweet) for the taste of soy sauce.

### **Soy sauce texture**

Panelists preferred the texture of soy sauce in the treatment of 450 g of peanut sauce and gude peanut sauce of 300 g, with the average being 4 (very thick). This is because the panelists prefer soy sauce with a very thick texture, the very thick texture of soy sauce is caused by the number of nuts used, so the texture of the soy sauce becomes very thick, this also happens because of the addition of brown sugar which causes a gel to form because sugar is mixed with water, there is a melting process and the texture of the soy sauce depends on the duration of the soy sauce maturation after being given seasonings (Ikrima, 2018). Texture is a sensation associated with touch or touch. Texture is also considered as important as smell, taste and aroma because it affects the image of food (Darni Lamusu, 2015). The resulting texture in the mouth is one of the parameters that determine consumer preferences for food products (Sinaga, 2007). The watery texture of the soy sauce or the low level of viscosity is said to be of poor quality. Therefore, the texture of soy sauce, namely viscosity, is an important parameter in soy sauce products, because it can be used as a control or control of the processing process (Nugraheni, 2008).

### **Smell of soy sauce**

Panelists prefer the aroma of soy sauce in the treatment of gude beans 300 g and 150 g which have an average value of 3 (fragrant), this is because the panelists do not really like soy sauce with a strong aroma. Because the fewer nuts are used, the aroma of gude beans is not too strong, because in gude beans it contains protease inhibitor enzymes. The protease inhibitor enzyme causes the distinctive smell of gude beans, and will cause a pungent aroma in foods, including soy sauce. For the treatment of 450 g peanuts, the average value given by the panelists was 4 (very fragrant). This is because the more nuts are used, the stronger the distinctive aroma of the gude beans will be. Therefore, if the number of beans used is higher, then in the salt fermentation stage (moromi) types of bacteria and yeasts will grow which will produce compounds by fermenting simple sugars and amino acids into lactic acid, acetic acid, and lactic acid. succinate which causes soy sauce to have a distinctive smell (Ikrima, 2018). According to Zuhrina (2011), the aroma spread by food is a very strong attraction and is able to stimulate the sense of smell so that it arouses the appetite. The emergence of the aroma of food is caused by the formation of volatile compounds as a result or reaction due to the work of enzymes or can also be formed without the help of enzyme reactions. Another factor is the natural interaction between the components of the aroma and the nutritional components in the meal such as carbohydrates, proteins and fats and the very relative consumer acceptance.

### **Soy sauce color**

Panelists preferred the color of soy sauce in the 450 g and 300 g of peanut gude soy sauce with an average value of 4 (very black), because on average the panelists preferred soy sauce with a very black color. The color of soy sauce is obtained because gude beans are black, black beans are obtained from anthocyanin pigments. Anthocyanins belong to a class of flavonoid compounds synthesized through phenylpropanoids, odorless and almost tasteless, contributing to a mild astringent sensation. Anthocyanins are pigments responsible for the red, purple and blue colors in fruits, vegetables, and some cereals. Anthocyanins can be used as a source of natural dyes and have antioxidant capacity (Satyatama, 2008). Therefore, the higher the number of nuts used, the darker the color of the soy sauce. According to Wade & Travis (2008), color is very important in assessing a food product because it is one of the parameters of consideration in choosing food. If the color is not attractive or does not match the color it should be, the consumer becomes less interested in consuming the food. Interest in food can be influenced by its color and texture. In the 150 g peanut soy sauce treatment, the average panelist gave a score for the soy sauce color parameter, namely 3 (black). This is because the less peanuts used, the less black the color of the soy sauce, so that the panelists did not like the 150 g gude peanut sauce with the black soy sauce color on average. The blackish brown color in soy sauce can be obtained from kluwak, brown sugar/palm which is used as a sweetener, and the browning reaction that occurs during salt fermentation during stage II fermentation (Suprapti, 2005).

### **Soy sauce taste**

The most preferred taste assessment by the panelists was in the treatment of 450 g of gude peanut sauce and 300 g of gude peanut sauce, with an average value of 3 (sweet). This shows that on average the panelists prefer soy sauce with a sweet taste, because the higher the number of nuts added, the moromi fermentation will produce amino acids, peptides, and organic acids that play a role in enriching the flavor and aroma (Astuti, 2016). The complexity of a taste is produced by the diversity of natural perceptions. Taste is influenced by three factors, namely smell, taste, and oral stimulation (hot and cold). The first factor can be detected by the sense of smell and the last two factors can be detected by sensory cells on the tongue (Wahidah, 2010). In 150 g of peanut gude soy sauce, on average the panelists gave a score of 2 (less sweet). This is because the panelists prefer soy sauce with a sweet taste, because



the fewer nuts used, which is 150, the less flavored moromi is produced during fermentation. In making soy sauce, spices and brown sugar are also added to raw soy sauce which acts as a taste enhancer, contains antibiotics, antimicrobial substances, antioxidants and vitamins. The brown sugar used aims to make the color of the soy sauce turn dark brown and give the soy sauce a taste and aroma (Ikriami Elma R, 2018).

## CONCLUSION

1. Results of the viscosity test of Kacang gude soy sauce based on the weight of the peanut, there is an effect on the viscosity because the weight of the nuts used is different, namely, Peanut Gude 150 g, Peanut gude 300 g, and Peanut gude 450 g with the highest viscosity of 608.065 cp with the weight of peanuts 450 g for gude beans, while for 300 g gude beans, 411.065 cp and 150 g gude beans were 141 cp and were the lowest viscosity.
2. Organoleptic test of gude peanut sauce 150 g had an average value of 3 (thick) for the texture of the soy sauce, the aroma of soy sauce got an average value of 3 (fragrant), and an average value of 3 (black) on the color of the soy sauce, and for the taste. The soy sauce in Peanut Gude Sauce 150 g has a lower value than the Peanut Gude soy sauce of 300 g and 450 g, which is 2 on average (less sweet) for the taste of soy sauce. Peanut gude soy sauce 300 g got an average value of 4 (very thick) for the texture of the soy sauce, while the aroma of soy sauce had an average value of 3 (fragrant), and an average value of 4 (very black) on the color of the soy sauce, and an average value of 4 (very black). average 3 (sweet) for soy sauce. Peanut gude soy sauce 450 g has an average value of 4 (very thick) for the texture of soy sauce, while the aroma of soy sauce has an average value of 4 (very fragrant), and the average value of soy sauce color gets the highest value of 4 (very black) from soy sauce. peanut gude 150 g and peanut sauce gude 300 g, and a value of 3 (sweet) for the taste of soy sauce.

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