



The Effect of Time Storage and Room Temperature of Physicochemical Characteristics of Frozen Edamame (Glycine Max (L))

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Abstract

Edamame is an agricultural product famous as vegetable soybeans. One of the edamame processed products is frozen edamame. Frozen edamame is a unique product frozen of souvenirs from Jember. This product is vulnerable to quality degradation due to the environment and consumer treatment. Consumers buy and carry products for souvenirs in a long journey and consumers are less precise in handling storage again when out of frozen storage. This study aims to improve the influence of storage room temperature with different time on the physical and chemical quality of original frozen edamame seeds and the influence of long storage with different time on the original organoleptic characteristics of frozen edamame. The results of tests conducted on the original edamame product during storage at room temperature affected the test results on color, texture, pH, total acid, moisture content and antioxidant activity, but had not affect on the total dissolved solids. The longer of storage at room temperature, the value of texture, color, total acid increases while the total dissolved solids, pH, moisture content and antioxidant activity decrease. The panelists organoleptic test assessment of the product during room temperature storage, panelists preferred P0 (0 hours) because the product was in fresh condition and of good quality compared to other treatments. During product storage at room temperature with different treatment times, the quality of the product has decreased in terms of color, texture, aroma, and taste.

Introduction

Edamame is one of the agricultural products in the form of green soybean vegetables. Edamame is a potential plant that has many benefits and high enough nutritional content for health such as isoflavones, vitamin A 100mg / 100g or carotene, vitamin B1 0.27 mg / 100 g, vitamin B2 0.14 mg / 100g, vitamin B3 1mg / 100g, 11.4 g protein, 7.4 g carbohydrates, 5.5 g fat, minerals such as 140 g calcium, 140 mg phosphorus, 1.7 mg iron and 70 mg calcium (Pambudi, 2013). Edamame plants are cultivated in several regions in Indonesia, including Gadog, West Java and Jember Regency. Edamame productivity in Jember Regency reaches 3,000 tons / year (Regional Development Agency for Jember Regency, 2010). Edamame soybeans are one of the leading commodities in Jember Regency as raw material for agro-industry, so that several companies in Jember have innovated to make edamame fresh and frozen.

Frozen original edamame is a ready-to-eat and practical food product. These products are processed with technology to maintain the quality of edamame. Frozen original edamame products have become one of the iconic souvenirs typical of Jember Regency. The enthusiasts of frozen edamame products are not only local people, but also people from outside the city. Consumers who buy frozen original edamame to be used as souvenirs and take products out of town with long and long distance travel without handling the product again. Travel with

uncertain distance makes frozen edamame products stored at room temperature for a long time without cold storage and with uncontrolled environmental conditions causing a decrease in quality.

A decrease in quality occurs when there is a physical change which indicates that the product is damaged. That is, seeds will be more easily damaged and experience physical changes such as appearance and odor that appear unwanted and pose a risk of bacterial growth. Therefore, this research was conducted to determine the effect of storage at room temperature with different times on the physical and chemical quality of edamame seeds and to determine the effect of original frozen edamame storage time with different times on organoleptic characteristics.

Methods

The tools used in the study included a Pnetrometer, Konica Minolta CR-10 color reader, Martini Mi-151 pH meter, RHB-32 hand refractometer, laboratory glassware. Original frozen edamame research materials obtained from PT. Mitra Tani Dua Tujuh the chemicals used were distilled water, 0.1 N NaOH, DPPH solution, 1% starch, label, 0.05% phenolphthalein (PP).

The method used in this study was a one-factor completely randomized design experimental method with three replications. The research design design can be seen in Table 1

Table 1. Research Design

Code	Time Treatment
P0	0 hour after removal from frozen storage (a control)
P1	12 hour after removal from frozen storage
P2	24 hour after removal from frozen storage
P3	36 hour after removal from frozen storage
P4	48 hour after removal from frozen storage

The research was carried out in two stages, the first stage was a test of physical and chemical properties. The parameters observed were color, texture, total dissolved solids, pH, total acid, water content, and antioxidant activity. The second stage is the favorite organoleptic test. The panelists who were involved were 30 panelists. The parameters observed were color, taste, aroma, texture and overall. The favorite organoleptic test scale uses a scale of 1-5; namely very like, like, somewhat like, dislike and very dislike.

Organoleptic test data were analyzed using SPSS 16 software with the Chi-Square test method. The analysis of physicochemical properties was carried out using one way analysis of variance (ANOVA). The antioxidant activity test used the paired sample t test method with a significant level of 5%.

Results and Discussion

Color a

The color value is a chromatic mixture of red and green. Based on a variety of colors, a sig level of $0.00 < 0.05$ indicates that during storage, room temperature has a significant effect between treatments. Based on the Duncan test with a level of 5%, it shows that there is no significant difference between the room temperature storage treatments for 0 and 12. However, there is a significant difference in the 24, 36 and 48 hours treatment. Figure 1 is a bar chart of the color value of frozen original edamame during room temperature storage with different treatment times.

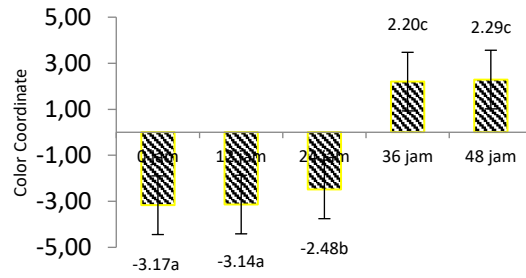


Figure 1. Colour a



Figure 2. Edamame Color Comparison

Figure 1 and Figure 2 show that the storage time at room temperature has a significant effect on edamame seeds. Storage of samples during room temperature with different times of color change occurs. The color change in edamame occurs because of the long storage time at room temperature to decompose because bacteria or microbes change the green pigment of edamame which tends to be yellow. Storage during room temperature ice crystals attached to the sample thaw in a tightly closed package and the sample will become wetter. This situation causes the growing microorganisms to make the sample change color to yellowish. According to Aminudin (2010), room temperature storage cannot maintain the green color of the edamame chlorophyll so that the green color will change quickly.

Color b

The value of b represents a chromatic mixture of yellow and blue. The higher b value indicates the color intensity level of yellow is positive and the b value which is negative indicates the intensity of the blue color. Based on the analysis of color variance b, the treatment during room temperature storage with sig 0.000 < 0.05 shows that it has a significant effect during storage at room temperature. The Duncan test showed that there was no significant difference in the 0 and 12 hours treatment. However, there were significant differences in the 24, 36 and 48 hours treatment. Figure 3 is a bar chart of the color value b of frozen original edamame during room temperature storage with different treatment times.

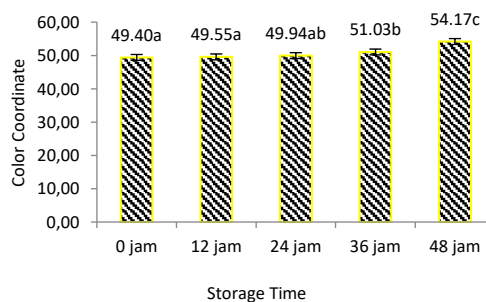


Figure 3. Color b

Figure 3 shows that the length of storage time at room temperature has a significant effect on edamame seeds. Storage at room temperature can affect the color of edamame, namely a change in the 24 hours treatment begins, the color leads to yellow. The long storage time for edamame at room temperature will cause the ice crystals to melt and be stuck in the packaging, as a result the sample is wet and causes mucus on the surface and the number of microorganisms that breed degrades the color. Winarno (2002) states that, the color change from green to yellow is due to chlorophyll degradation. The longer the storage at room temperature, the higher the rate of putrefaction so that the microbial decay reaction takes place faster (Purwanto & Weliana, 2018).

Texture

Texture analysis was performed to determine the hardness level of the five edamame seed samples. The results of variance with sig 0.000 < 0.05 showed that between treatments, storage time at room temperature had a significant effect. The 5% Duncan test showed that between treatments, the storage time at room temperature experienced a change in the texture of the edamame seeds in the 24 hour treatment. Figure 4 is a bar chart of the texture value during room temperature storage with different treatment times.

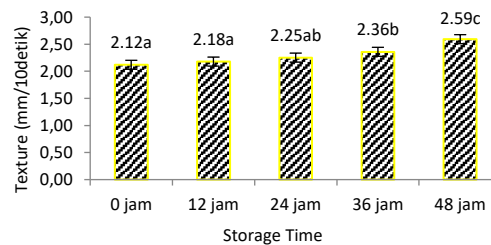


Figure 4. Texture

Figure 4 shows that storage time at room temperature has a significant effect on edamame seeds. The results of measuring the hardness level of original edamame seeds during storage at room temperature with 0 and 12 hours treatment were not significantly different. However, the changes in the texture of the 24 36 and 48 hours treatments were different. The observed frozen original edamame products undergo a thawing process, namely a process for refreshing from frozen materials. During the thawing process, the ice crystals thaw. Melting indicates the presence of water activity from ice crystals which results in growth and microbial activity in the sample so that the texture is softer. The activity of water in packaging affects the development of chemical and microbiological decay reactions in food (Husna, 2008). The longer the storage, the faster the decay rate due to the remodeling that occurred in the original edamame. The overhaul occurs because polysaccharides are increasingly broken down and cell wall compounds in the form of protopectin do not dissolve into soluble pectin (Purwadi et al., 2007).

Total Dissolved Solids (TDS)

The total dissolved solids content shows the content of the ingredients dissolved in the solution in the original edamame seeds. Based on the results of analysis of variance, it shows that there is no significant effect with sig 0.115 > 0.05. The Duncan test for total dissolved solids of original edamame showed that the 0 hour, 12 hour and 24 hour treatment were significantly different, there was a significant difference between the treatment of storage time at room temperature. Figure 5 is a bar chart of the total value of dissolved solids during storage at room temperature with different treatment times.

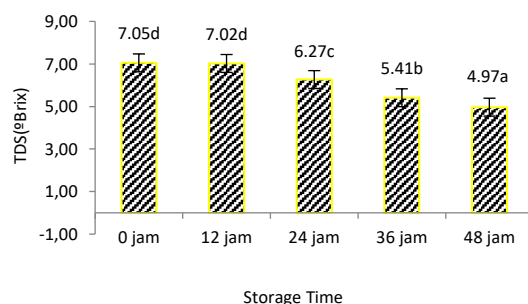


Figure 5. Total Dissolved Solids

Figure 5 shows that the storage time treatment at room temperature has a significant effect on edamame seeds. The results of the analysis of the total value of dissolved solids decreased. This decrease occurs when the presence of melting ice crystals and lots of water in plastic packaging causes microbial proliferation which causes the growth of fungi and decay of the material, as a result of which there is dehydration and active microbial activity which decreases the sugar content and breaks down nutrients (Fendriansah et al., 2014). During storage, room temperature affects the total dissolved solids because the process of changing carbohydrates in the form of gluoxane and fructose found in edamame will become more acidic so that it decreases. A decrease in the value of TPT, which indicates a decrease in sucrose levels during storage, the longer the sample experiences decay. This is indicated by the presence of microorganisms so that carbohydrates are degraded into organic compounds (Fardiaz, 1992 in Farikha et al., 2013).

pH

The degree of acidity shows the acidity of a material. The results of the analysis of storage time at room temperature with different treatment times had an effect on the edamame seed extract. The calculation of variance with a sig value of $0.000 < 0.05$ shows a significant effect. Treatment 0 hours to 48 hours showed a real difference. The results of the analysis of differences in treatment had a significant effect on the degree of acidity, followed by the Duncan test with a level of 5% showing that all treatments were significantly different with the highest pH value at 0 hours treatment and the lowest treatment 48 hours. Figure 6 is a bar chart of the pH value during room temperature storage with different treatment times.

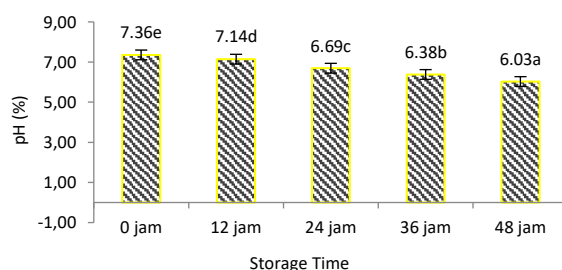


Figure 6. pH

Figure 6 shows that the storage time treatment at room temperature has a significant effect on edamame seeds. Storage time for 36 and 48 hours closed and stored at room temperature ice crystals attached to the material that has undergone thawing. Thawing causes the material to become wet and soggy, the wet condition of the material causes the growth of small fungi on the surface and bacterial activity causes the pH value to change rapidly (Fahrurrozi, 2011). Decrease in pH value due to reduced sugar content and increased acid content. This is caused by the formation of acids due to the spontaneous reaction between CO_2 and H_2O . CO_2 gas is

formed when the sucrose breaks down into simpler units (Desrosier, 1988 in Farikha et al., 2013).

Total Acid

Total acid is calculated as the total content of organic acids in food products. The difference in time variation during room temperature storage can affect the total acid of original edamame seeds. The results of analysis of variance with sig 0.03 < 0.05 showed a significant effect on treatment. Based on the Duncan test with a level of 5%, it shows that the 0 hour treatment is significantly different from other treatments. Figure 7 is a bar chart of the total acid value during room temperature storage with different treatment times.

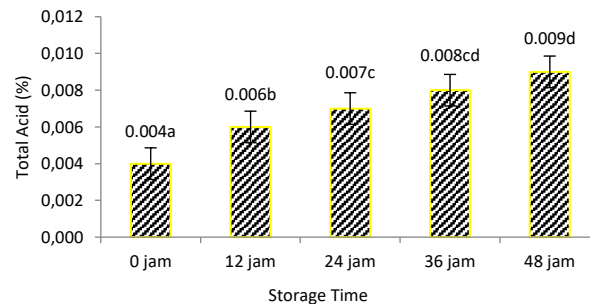


Figure 7. Total Acid

Figure 7 shows that the storage time at room temperature has a significant effect on edamame seeds. In Figure 4.6, changes began to occur in the 24 to 48 hour treatment, which is significantly different. Prolonged storage at room temperature causes frozen samples to thaw. The liquefaction that occurs will increase water activity and microbial activity in the sample, the presence of active microbes utilizing fermentable carbohydrates and will produce organic acids during room temperature storage. Estiasih & Achmadi (2009) state that the increase in total acid is due to the original edamame having a lower pH, where the lower the pH the total acid will increase.

Water Content

Water content is an important component in determining food quality such as original edamame. Water content can affect the shelf life and freshness of food products. The results of the analysis of the various values of the original edamame moisture content during room temperature storage with sig 0.000 < 0.05 showed that it had a significant effect on the inter-treatment during room temperature storage. Duncan's test with a level of 5% showed that the 36 and 48 hours of treatment were significantly different from other treatments. Figure 8 is a bar chart of water content values during room temperature storage with different treatment times.

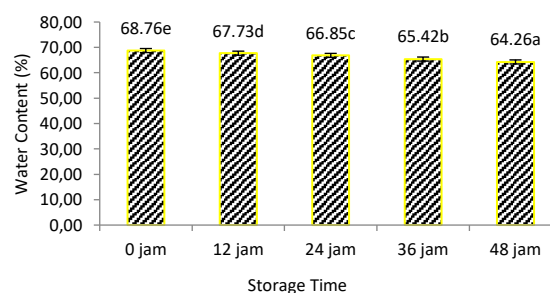


Figure 8. Water Content

Figure 8 shows that storage at room temperature has a significant effect on edamame seeds. In Figure 8 there is a different decrease starting at 36 hours of treatment. The longer the sample storage at room temperature results in more water lost because the storage process will make the ice crystals in the frozen sample melt in the plastic package. The process of melting ice crystals is due to uncontrolled room temperature and low RH so that water evaporates from the sample and reduces the water content of the sample. The decrease caused by room temperature conditioning occurs transpiration. The transfer of temperature from the initial cold temperature storage to room temperature and temperature changes will cause a decrease in water content due to an increase in water evaporation which will affect the quality and shelf life (Suhardi, 1995 in Asgar & Rahsayu, 2014).

Antioxidant Activity

Measurement of the value of antioxidant activity is based on the capture of DPPD stable free radicals which can react with other radicals to form a stable compound.

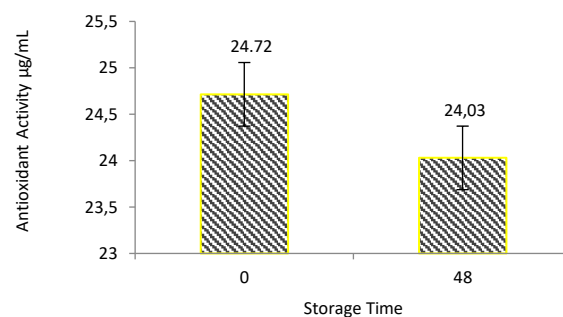


Figure 9. Antioxidant Activity

The results of the analysis of the variance of antioxidant activity with a significance level of 5% showed the t value of $27,400 < 6,314$, the value of t table which means it is not significant. Meanwhile, Sig. (2-tailed) shows a value of $0.023 < 0.05$, which means that there is a significant difference in the treatment of the original control edamame seed samples (0 hours) and 48 hours. The mean value of 0.02500 which is positive means that there is a tendency to decrease antioxidant activity in the 48-hour treatment with an average decrease of 0.02500. Room temperature storage time affects the antioxidant activity of edamame. The decrease occurs because edamame captures other radical compounds such as hydrogen peroxide in the metabolic processes in its cells. According to Suryanto & Wehantouw (2009), hydrogen peroxide radicals are less reactive and under certain conditions toxic which results in increased hydroxyl content.

Organoleptic Test

The overall liking test to determine and measure the level of preference for the panelists to all parameters such as color, aroma, taste and texture produced different values (Gustiar, 2009). Based on the results of the analysis of the preference test using chi-square with a significance level of 5%, the count value of $41,600 > 26,296$, the table value shows that room temperature storage has a significant effect on the level of preference for panelists to the overall original edamam. Figure 10 is a bar chart of the overall preference level during room temperature storage with different treatment times.

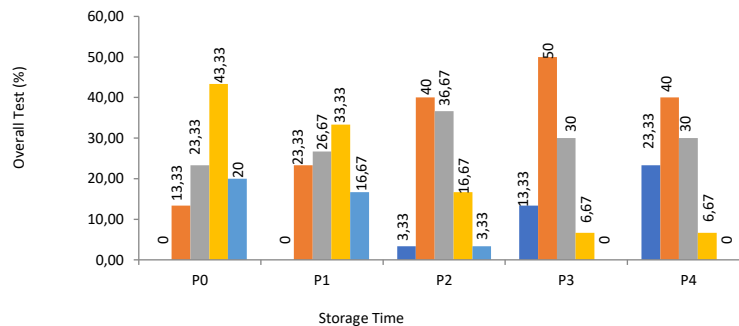


Figure 10. The panelist's level of liking for the whole edamame original

Based on Figure 10, it shows the level of preference for all panelists to the original edamame such as color, aroma, taste and texture. The P0 treatment was carried out by storing room temperature. Overall, the panelists preferred those who still had a fresh green color, sweet taste, distinctive aroma of edamame and a harder and crunchy texture. Room temperature storage treatment with treatment P1, P2, P3 and P4 the longer the storage at room temperature, the panelists showed the less liked it in terms of color, aroma, taste and texture. The entire treatment time during storage of original edamame can accelerate the physical and chemical changes that occur in edamame. The longer the storage, the lower the overall liking rate. This is in accordance with the opinion of Irawan et al. (2014) which states that the overall acceptance of food can be measured from the color, aroma, taste, and texture segments.

Conclusion

Different treatment times during storage at room temperature influenced the test results of color, texture, pH, total acid, water content and antioxidant activity, but did not affect the total dissolved solids. The longer the storage at room temperature, the value of texture, color, total acid increases while the total dissolved solids, pH, moisture content and antioxidant activity decrease. Frozen original edamame products as long as room temperature storage are still in good condition to be consumed a maximum of 12 hours after being removed from the freezer. Based on the organoleptic test assessment of the product during room temperature storage, the panelists preferred P0 treatment (0 hours) because the product was still fresh and of good quality compared to other treatments. During product storage at room temperature with different treatment times, the quality of the product has decreased in terms of color, texture, aroma, and taste.

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