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# Studi Umur Simpan Selai Buah Pedada (*Sonneratia caesolaris*) dengan Penambahan Karagenan

# Shelf Life Study of Pedada Fruit Jam (*Sonneratia caesolaris*) With The Addition of Carrageenan

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**Abstrak**

Buah Pedada (*Sonneratia caseolaris*) memiliki kandungan fitokimia seperti steroid, tripenoid dan flavonoid. Senyawa fitokimia merupakan antioksidan yang menetralisir radikal bebas yang menyerang sel-sel tubuh. Aplikasi pembuatan selai buah pedada dengan penambahan karagenan dapat berfungsi salah satunya sebagai pengawet alami. Tujuan dari penelitian ini adalah mengetahui perngaruh penambahan karagenan terhadap lama simpan selai buah pedada. Perlakuan penelitian terdiri dari lama penyimpanan 0 minggu (P0), 1 minggu (P1), 2 minggu (P2), 3 minggu (P3), dan 4 minggu (P4). Parameter yang diamati dalam penelitian ini adalah uji antibakteri dengan *Total Plate Count*, uji viskositas, dan uji aktivitas antioksidan menggunakan spektrofotometer Uv-Vis. Data yang diperoleh diuji dengan uji statistik ANOVA dan dilanjutkan dengan uji DMRT. Hasil penelitian menunjukkan bahwa aktivitas antioksidan dan viskositas disetiap lama penyimpanan memiliki nilai yang semakin menurun, sedangkan aktivitas mikrobiologi berbanding terbalik dengan aktivitas antioksidan dan viskositas yaitu dengan nilai yang semakin meningkat disetiap lama penyimpanan. Lama penyimpanan selai buah pedada dengan penambahan karagenan berpengaruh nyata pada aktivitas antioksidan, viskositas, dan aktivitas mikrobiologi dimana memiliki nilai yang berbeda signifikan ($p < 0,05$).

**Kata kunci:** Karagenan, lama simpan, selai buah pedada, *Sonneratia caesolaris*

**Abstract**

Pedada fruit (Sonneratia caseolaris) contains phytochemicals such as steroids, tripenoids and flavonoids. Phytochemical compounds are antioxidants that neutralize free radicals that attack body cells. The application of making pedada fruit jam with

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the addition of carrageenan can function as a natural preservative. The purpose of this study was to determine the effect of adding carrageenan to the shelf life of pedada fruit jam. The research treatment consisted of 0 week of storage (P0), 1 week (P1), 2 weeks (P2), 3 weeks (P3), and 4 weeks (P4). Parameters observed in this study were the total plate count test, viscosity test, and antioxidant activity test with spektrofotometer Uv-Vis. The data obtained was tested with the ANOVA statistical test and continued with the DMRT test. The results of the research show that antioxidant activity and viscosity have decreasing values with each storage period, while microbiological activity is inversely proportional to antioxidant activity and viscosity, namely with increasing values with each storage period. The storage time for pedada fruit jam with the addition of carrageenan had a significant effect on antioxidant activity, viscosity and microbiological activity which had significantly different values ($p < 0.05$).

**Keywords:** Carrageenan, shelf life, pedada fruit jam, *Sonneratia caesolaris*

## 1. Pendahuluan

Indonesia is a country that has abundant natural resources, especially in the water area. Not only water areas, coastal or coastal areas in Indonesia have long coastlines and large *mangrove* forest areas (Buana *et al*., 2015). *Mangrove* forests are one of the unique ecosystems and have an important role in coastal areas. *Mangrove* forests have high economic and ecological value because of the diversity contained in them, but are very vulnerable to damage if they are not wise in maintaining, preserving and managing them (Ritohardoyo and Ardi, 2014). Mangrove forests in it there are many plants, one of which is *the* species *Sonneratiaceae (Sonneratia*). Mangrove fruit of the type *Sonneratia* or commonly called pedada fruit is often found in brackish water areas, the characteristics of this fruit are at the base wrapped in spherical petals, and the tip of the fruit is stemmed. The fruit is not poisonous and can be eaten directly, this fruit has a sour taste and distinctive aroma that is the attraction of the fruit (Setiawan *et al*., 2016).

Pedada fruit has a very high nutritional content, but knowledge of the nutritional content is still lacking, so the information on processing the fruit is still very limited. Pedada fruit has been widely processed to be used as several food and beverage products such as one of them is jam (Salsabila *et al*., 2023). Jam is a product made by cooking crushed fruit mixed with sugar, with or without the addition of water and has a soft and plastic texture. Jam is a food that can be made from fruits that taste sour. Jam can be made from the heating process of a mixture of fruit pulp and sugar (Arsyad and Abay, 2020).

The use of food additives that function as preservatives aims to inhibit or stop microbial activities such as bacteria, mold, yeast, so as to increase the shelf life of a processed product, improve taste, color, stabilize and improve texture, as a thickening agent or stabilizer, prevent discoloration, enrich vitamins, minerals and so on. One of the natural food additives is carrageenan (Setiawan *et al*., 2016). Carrageenan is a hydrocolloid compound belonging to the galactose polysaccharide group which is extracted from seaweed (Saputra *et al*., 2021).

Carrageenan is one of the products of seaweed extraction that is often used in various industrial fields. Carrageenan in the industrial field is generally used as a stabilizer, thickener, geller, emulsifier, binder, preservative, and crystallization prevention in the food or beverage, pharmaceutical and other cosmetic industries (Herawati, 2018), in order to optimize the potential of marine and fisheries carrageenan as a natural thickener can be used in making pedada fruit jam because in addition to functioning as a thickener, carrageenan can also function one of them as a preservative natural. According to Nasution (2019), carrageenan is a good alternative to be able to increase durability and extend shelf life. Carrageenan contains phenolic compounds that can function as antioxidants, contains antibacterial compounds and is a hydrocolloid compound that can bind and absorb water. Therefore, further research is

needed related to the shelf life of pedada fruit jam with the addition of carrageenan as a natural preservative (Erjanan *et al*., 2017).

## 2. Material and Method

The materials used in this study include pedada fruit, PCA media, physiological NaCl, carrageenan flour, sugar, water, *methanol, aquadest*, *aluminum foil*, tissue, and DPPH solution. This study used a complete randomized design with a storage duration consisting of five treatments and three repeats, so that 30 experiments were obtained. The treatment in testing the shelf life of jam in this study refers to Nanda *et al*. (2019). The sample will be coded P0, P1, P2, P3, P4 (P0 = 0 days week period (control), P1 = 1 weeks storage duration, P2 = 2 weeks storage duration, P3 = 3 weeks storage duration, and P4 = 4 weeks storage duration).

The process of making pedada fruit jam refers to the method of Setiawan *et al*. (2016) and Putra *et al*. (2022). Pedada fruits are prepared as much as 1 kg. The pedada fruit is then peeled off the skin and then washed thoroughly until there is no skin left attached to the fruit. Peeled pedada fruit is put into a pot and added 1 liter of water, then stirred until it becomes pedada fruit pulp. After that, a filtering process is carried out until fruit juice is obtained. Next, dissolve 2kg of granulated sugar and heated at a temperature of 50-60$^{o}$C followed by a stirring process using a stirring rod for approximately 1 minute until the sugar is completely dissolved a. The next step is to add carrageenan as much as 1.25% to the juice that has been heated , then stirred manually until homogeneous and obtained pedada fruit jam. Pedada fruit jam will be packed in glass packaging that has previously been sterilized using an autoclave, after which it is tightly closed. Pedada fruit jam will be stored at room temperature (25$^{o}$C) . The following table of pedada fruit jam formulations can be seen in Table 1.

The research data will be analyzed statistically using 1 factor Analysis of Variance (ANOVA) to determine the effect and differences between the treatments given. Treatments that show significant results can be continued with the Duncan Multiple Range Test (DMRT) advanced test using an accuracy of 95%.

## 3. Results and Discussion

*Result*

*a. Antioxidant Activity*

Antioxidants are compounds with molecular structures that are able to provide electrons to free radical molecules and are able to break the free radical chain reaction. Measurement of high and low antioxidant activity of samples using the DPPH free radical capture method is known from the percent of inhibition expressed in % inhibition (Wulansari, 2018).

**Table 2.** Antioxidant activity of pedada fruit jam

| No. | Storage Duration | Average ±SD |
|---|---|---|
| 1. | Week-0 | $80.31^{a}$ ± 5.03 |
| 2. | Week-1 | $73.52^{a}$ ± 3.36 |
| 3. | Week-2 | $61.88^{b}$ ± 3.36 |
| 4. | Week-3 | $52.18^{C}$ ± 6.05 |
| 5. | Week-4 | $37.63^{s}$ ± 3.36 |

The test results of the antioxidant activity of pedada fruit jam with the addition of carrageenan are presented in Table 2. Antioxidant activity at week 0 obtained a % inhibition value of 80.31%. The length of storage in week-1 got a value of 73.52%, week-2 got a value of 61.88%, week-3 with a value of 52.18%, and week-4 with a value of 37.63%. Pedada fruit jam with the addition of carrageenan with different storage durations showed a difference and a significant influence on the value of antioxidant activity where a significance

value was obtained in the ANOVA p test < 0.05, so that further DMRT (Duncan Multiple Range Test) was carried out where the highest antioxidant value was obtained in the storage treatment at week-0. The value of antioxidant activity decreases with the increase in the shelf life of pedada fruit jam. The lowest antioxidant value was obtained at 4th week of storage.

*b. Viscosity*

Viscosity is the viscosity range in a product, where the greater the viscosity value contained in a material, the material can be said to have a high viscosity. Viscosity measurement in a material using a measuring instrument called a viscometer (Regina *et al*., 2018).

**Table 3.** Viscosity test of pedada fruit jam

| No. | Storage Duration | Average ±SD |
|---|---|---|
| 1. | Week-0 | $306.67^{a} \pm 7.64$ |
| 2. | Week-1 | $298.33^{b} \pm 2.89$ |
| 3. | Week-2 | $271.67^{C} \pm 2.89$ |
| 4. | Week-3 | $199.33^{s} \pm 1.16$ |
| 5. | Week-4 | $152.33^{e} \pm 2.52$ |

Pedada fruit jam with the addition of carrageenan in week-0 and week-1 gets a viscosity value that is not much different from week-0, where week-0 gets a value of 306.67 dPa.s and in week-1 298.33 dPa.s, then in week-2 gradually decreases where a value of 271.67 dPa.s, week-3 gets a value of 199.33 dPa.s, and week-4 with the lowest value of 152.33 dPa.s. (Table 3). Based on these results, pedada fruit jam with the addition of carrageenan with different storage durations showed a difference and a significant influence on viscosity values where significance values were obtained in the ANOVA p test < 0.05, so that further DMRT (Duncan Multiple Range Test) was carried out where the highest antioxidant value was obtained in storage treatment at week-0. The viscosity value decreases as the shelf life of pedada fruit jam increases. The lowest viscosity value is obtained at the 4th week of storage.

c. Microbiological Activity

The TPC (*Total Plate Count*) test method aims to determine the number of microbes or bacteria contained in a material by counting bacterial colonies grown in agar media (Yunita *et al*., 2015). Based on the quality requirements of jam (SNI 3746: 2008) it is explained that *the Total Plate Count* value on jam is a maximum of $1x10^{3}$ Colonies/g, so it is necessary to do TPC testing on pedada fruit jam (BSN, 2008).

**Table 4.** Microbiological activity of pedada fruit jam

| No. | Storage Duration | Average ±SD |
|---|---|---|
| 1. | Week 0 | $0.00^{a} \pm 0.00$ |
| 2. | Week 1 | $0.00^{a} \pm 0.00$ |
| 3. | Week 2 | $123.67^{b} \pm 12.34$ |
| 4. | Week 3 | $363.33^{C} \pm 12.22$ |
| 5. | Week 4 | $506.00^{s} \pm 5.29$ |

Pedada fruit jam with the addition of carrageenan in week-0 obtained the value of microbiological activity in the TPC test with a result of 0 CFU/mL, then after the jam was stored for 1st week still obtained the same result of 0 CFU/mL, After storage for 2nd weeks, the value of microbiological activity was obtained results of 123.67 CFU/mL, where there was microbiological activity in week-2, In weeks-3 and 4, it was found that microbiological activity in pedada fruit jam tended to increase where each of them obtained results with an average of

363.33 CFU/mL and 506.00 CFU/mL, where the highest value of microbiological activity was found in the 4th week of storage. Based on the results above, it shows that there is a real difference and influence on the TPC test value where the significance value of the ANOVA p test < 0.05. DMRT (Duncan Multiple Range Test) was carried out where the TPC test value was compared with the antioxidant activity test value and viscosity test, the lowest TPC (*Total Plate Count*) test value was obtained in the storage treatment at week-0, whereas, the highest TPC test value was obtained at the 4th week of storage.

*Discussion*

Antioxidant activity in samples was tested using the DPPH method where antioxidant activity was determined by the magnitude of DPPH resistance expressed in % inhibition. Percent inhibition in free radical suppression is the ability of a substance that is antioxidant in inhibiting free radicals related to the concentration of the sample tested. The greater the percentage of inhibition value produced, the higher the antioxidant activity (Utami *et al*., 2016).

This decrease in antioxidant activity can be caused by several factors such as pH, oxygen, light, and temperature. The pH value of a material has an important influence on antioxidant stability where previous studies have shown antioxidant stability in miana plants is very good at acidic pH and unstable at neutral and alkaline pH. Likewise with the influence of temperature and storage time. Storage temperature as well as processing process temperature can affect the degradation of compounds that provide antioxidant activity (Giuliana *et al*., 2015).

A good viscosity value is recommended in the range of 200-400 dPa.s (Suryani *et al*., 2019). The highest viscosity value was obtained in week 0 and week with a value of 307 dPa.s and the lowest value was obtained in week 4 with a value of 152 dPa.s. The decrease in the viscosity value of jam is due to water escaping from the jam. During storage, glucose will be hydrolyzed so that the water content in the jam will increase resulting in the jam getting thinner. This is in line with research conducted by Solichah *et al*. (2023) which states that the longer the jam is stored, the amount of water contained in the food increases, so that the free water that comes out of the food is more and more and causes the viscosity of the jam to decrease. This decrease in viscosity is also caused because the longer the storage, the viscosity will decrease due to syneresis. Syneresis occurs as a result of the bond of carrageenan and water weakening so that water is free to come out and fill the spaces between cells (Saramban and Purwani, 2018). Some factors that can affect viscosity include temperature, dissolved molecular weight, solution concentration, and pressure. Temperature is inversely proportional to viscosity. If the temperature rises then the viscosity will drop, and vice versa. The concentration of the solution is directly proportional to the viscosity. A solution with a high concentration will have a high viscosity as well, because the concentration of the solution expresses the number of particles of solute per unit volume. The more particles that are dissolved, the friction between particles is higher and the viscosity is higher. Viscosity is directly proportional to the molecular weight of the solute. Because the presence of a heavy solute will inhibit or put a heavy load on the liquid so that it can increase viscosity and the higher the pressure, the greater the viscosity of a material (Putri and Kasli, 2017).

According to previous research conducted by Setiawan *et al*. (2016), pedada fruit jam has a water content value of 26.84% where the water cada value is greater than pedada fruit jam with the addition of carrageenan which has a water content of 16.2%. Fruit jam without the addition of preservatives can last up to 5 days (Sugandi *et al.,* 2020). The presence of water content in food is often associated with the quality of

foodstuffs, as a determinant of the stability index during storage. Food stability and quality are directly influenced by water content (Sundari *et al*., 2015).

High moisture content can cause products to be damaged more easily, due to the presence of damaging microorganisms that utilize the amount of water contained in the product for its growth. The high water content makes it easy for bacteria, molds and yeasts to multiply, so there will be changes in food (Sjarif *et al*., 2021). Judging from the TPC test results obtained, pedada fruit jam with the addition of carrageenan can extend the shelf life. This is because carrageenan flour is hydrophilic, which can bind water. According to Supriyantini *et al*. (2017), carrageenan flour has properties that can bind strong water and polar and nonpolar compounds so that it can form a gel. Carrageenan functions to form a three-dimensional network with sugar and water under synergistic conditions, with the formation of a three-dimensional network, water will be trapped and not easily come out (Sipahutar *et al*., 2020).

## 4. Conclusion

Based on the results of research on different storage periods in pedada fruit jam with the addition of carrageenan, it can be concluded that different storage hours in pedada fruit jam with the addition of carrageenan have a real effect ($p < 0.05$) on the value of antioxidant activity, viscosity, and microbiology. Antioxidant activity and viscosity are getting lower every week, and inversely proportional to microbiological activity where microbiological activity tends to increase every week.

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## Conflict of Interest

The author declares no financial or commercial conflict of interest.

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