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Optimizing the Preservation of Fresh Tomatoes into Tomato Dates to Increase the Shelf Life of Vegetable Food

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Abstract

Tomato is currently one of the high economic value horticultural commodities and still requires serious treatment, especially in terms of increasing the yield and growth of tomatoes. This research will be carried out by Hospitality Laboratory in STIEPARI Semarang. The material used is tomato and sugar. The method used is making tomato dates, observing the deterioration kinetics of tomato candied quality, estimating shelf life of tomato sweets and adding sugar. The results of this study indicate that preservation of fresh tomatoes into tomato dates to increase the storability of plant foods (P <0.05). Vegetable food has a high fiber content so that the physical properties of plant foods, so that with a preservation system using sugar can increase the shelf life of vegetable products. Research result Based on the organoleptic results (color) of tomato dates presented in the table, it shows that tomato dates with the addition of sugar as much as T0 (0% Tomato Dates 0% Sugar), T1 (Tomato Dates 30% Sucrose) both were still in the like category, while T2 Tomato Dates were 30% Lactose) and T3 Tomato Dates 30% Fructose) both were in the very like category. Based on the organoleptic results (aroma) of tomato dates presented in the table, it shows that tomato dates with the addition of sugar as much as T0 (0% Tomato Dates 0% Sugar), T1 (Tomato Dates 30% Sucrose) and T2 (Tomato Dates 30% Lactose) are still in the category likes, while T3 Tomato Dates 30% Fructose) is in the very like category. While at T2 (30% Lactose Tomato Dates) showed liking, and T3 Tomato Dates 30% Fructose) showed very liking. While the formula T3 Tomato Dates 30% Fructose) which shows the category of very like. namely the addition of 40gr lactose as much as 84% while the lowest lactose content was the addition of 20gr lactose as much as 20gr.

Keywords
Tomatoes; sugar; preservatives.

I. Introduction

National tomato production based on sources from the Central Agency and the Directorate General of Horticulture of each province in Indonesia produces tomatoes of good quality. In Central Java, tomato production was in 2011 (14.51 tons/ha), 2012 (13.99 tons/ha), 2013 (13.07 tons/ha), 2015 (14.28 tons/ha). With the large number of tomatoes harvested in Central Java, during the harvest season, the price of tomatoes tends to be cheap and the shelf life of the harvest is short and many tomatoes are damaged due to too long storage after harvesting from the tree, but they cannot be processed properly.

Tomato fruit is currently one of the horticultural commodities with high economic value and still requires serious handling, especially in terms of increasing the processed yield

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and growth of tomato fruit (Romer, 2000). The ability of tomatoes to produce fruit is highly dependent on the interaction between plant growth, genetics and environmental conditions. Another factor that causes low tomato production is fertilizer conditions that are not optimal. In addition, at this time the processing of fresh tomatoes has not been maximized so that many tomatoes are only sold in fresh conditions. Tomat is one of the horticultural commodities that have high economic value and is expected to become an export commodity if the public can develop both fresh and processed tomatoes.

Dates (Phoenix dactylifera) is a palm plant (Arecaceae) in the genus Phoenix, the fruit is edible. Although the place of origin is unknown because it has been cultivated for a long time, it is likely that this plant came from the land around the Persian Gulf. It is a medium-sized tree about 15-25 m tall, growing singly or in clumps on a number of trunks from a single root system. The leaves are 3-5 m long, with spines on the petiole, pinnate and have about 150 young shoots; the young leaves are 30 cm long and 2 cm wide. The full span of the crown ranges from 6-10 m. in Indonesia there are date palm trees that are planted from seeds from the middle east, the trees can be fertile in Indonesia but are not optimal when they bear fruit so that in Indonesia it can be said that they cannot produce dates, so there is a need for other ways to enjoy the dates that are produced. Processed from other materials.

The use of tomatoes will be utilized as a basic ingredient in the manufacture of dates. Utilization of this tomato has the main problems that will be discussed by researchers, namely as follows:

a. How does the tolerance level of tomatoes affect exposure to sugar derivatives (glucose, lactose, and fructose) on the shelf life of processed vegetable foods?
b. How is the effect of tomato date antioxidant levels based on storage time?
c. How does storage time affect the organoleptic quality of tomato dates?
d. How does the tolerance level of tomatoes affect exposure to sugar derivatives (glucose, lactose, and fructose) and their impact on organoleptic quality?
e. How is the effect of the total number of tomato date colonies during the measurement of shelf life?

This research has several objectives, including:

a. Analyzing the tolerance level of tomatoes to exposure to sugar derivatives (glucose, lactose, and fructose) on shelf life as processed vegetable foods.
b. Analyzing the antioxidant levels of tomato dates based on drying time.
c. Analyzing the effect of drying time on the organoleptic quality of tomato dates processed from vegetable foods.
d. Analyzing the tolerance level of tomatoes to exposure to sugar derivatives (glucose, lactose, and fructose) and their impact on organoleptic quality.
e. Analyzing the total number of tomato date colonies during the measurement of shelf life.

II. Review of Literature

2.1 Overview of Preservation

Preservation is an action taken by humans on food ingredients in such a way that the material is not easily damaged. Preservation is the steps taken to maintain the quality of food and is still safe for consumption. In the preservation process can be done in several ways, for example by salting and sugar or can be done with chemicals (Leistner, 2000).

2.2 Overview of Tomato Fruit

Local fruits and vegetables contribute to food security in the region through optimizing the utilization of resources of local fruits and vegetables as a provider of food. Associated with growing food needs, the necessary efforts to increase the utilization of crop diversity to meet human needs (Pugalenthi et al, 2005). Local fruits and vegetables are a natural supermarkets for residents in the area. Local fruits and vegetables contain a variety of phytonutrient that also provide important nutrients in the area, which may not be available in the absence of local fruits and vegetables. Fruits and vegetables in general is one commodity that is necessary for humans to live a healthy life. Fruits and vegetables are sources of water and nutrients, a source of vitamins and is one of the largest natural source of antioxidants in the world (Saleh in Komarayanti, S. et al. 2018).

Tomato plants are vegetables that have been known for a long time. Its important role in fulfilling community nutrition has long been known to people. Tomato plants (Lycopersium esculentum Mill) are annual plants, in the form of shrubs or shrubs and are included in the flowering plant group (angiosperms). In plant classification, tomato plants belong to the class dicotyledonnae (two pieces) (Fischhoff, 1987).

Tomato stems, although not as hard as perennials, are strong enough. The color of the stem is green and is rectangular to round in shape. On the surface of the stem is overgrown with fine hair, especially in the colored part a green.

2.3 Overview of Dates

The date palm tree with the Latin name Phoenix Dactylifera is a palm plant (Arecaceae) in the Phoenix genus, the fruit is edible. It is a medium-sized tree about 15-25 m tall, growing singly or in clumps on a number of trunks from a single root system. The leaves are 3-5 m long, with spines on the petiole, pinnate and have about 150 young shoots; The young leaves are 30 cm long and 2 cm wide. The full span of the crown ranges from 6-10 m. scientific classification of the date palm tree consists of, Kingdom (Plantae), Division (Maagnoliophyta), Class (Liliopsida), Order (Arecales), Family (Arecaceae), Genus (Phoenix), Species (P. dactylifera).

Dates have an oval-cylindrical shape with a length of 3-7 cm and a diameter of 2-3 cm. Dates when young have a bright red to brass color. Dates have a single seed that is 2-2.5 cm long and 6-88 mm thick. Dates are grouped into three main groups, namely: soft, semi-dried and dry, dry fruit types contain glucose, fructose and sucrose (Fischer, 2003).

Table 1. Content of dried dates (edible part)

Nutritional Value Per 100 g (3.5 oz)	
Energy	1.180 kJ (280 kcal)
Carbohydrate	75 g
- Sugar	63 g
- Dietary fiber	8 g
Fat	0.4 g
Protein	2.5 g
Water	21 g
Vitamin C	0.4 mg (1%)
Manganese	0.262

2.4. Overview about Sugar

a. Glucose

Glucose, a monosaccharide sugar, is one of the most important carbohydrates used as a source of energy for animals and plants. Glucose is one of the main products of photosynthesis and the beginning of respiration. The natural form (D-glucose) is also called dextrose, especially in the food industry. Glucose ($C_6H_{12}O_6$, molecular weight 180.18) is a hexose—a monosaccharide containing six carbon atoms. Glucose is an aldehyde (contains -CHO group). Its five carbons and one oxygen form a ring called the "pyranose ring", the most stable form for the six-carbon aldose. In this ring, each carbon is bonded to a hydroxyl and hydrogen side group except for the fifth atom, which is bonded to the sixth carbon atom outside the ring, forming a CH_2OH group. This ring structure is in equilibrium with the more reactive form, the proportion of which is 0.0026% at pH 7 (Rossetti, 1990).

b. Lactose

Lactose is a disaccharide form of carbohydrates that can be broken down into simpler forms, namely galactose and glucose. Lactose is present in milk, and makes up 2-8 percent of the total milk weight. It has the chemical formula $C_{12}H_{22}O_{11}$. Lactose is a disaccharide derived from the condensation between galactose and glucose, which forms 1→4-β glycoside bonds. The systematic name for lactose is -D-galactopyranosil-(1→4)-D-glucose. Lactose is hydrolyzed to form glucose and galactose

In milk, lactose is 2-8 percent of the weight of milk when calculated as a whole. Discovered in 1619, lactose is also found in milk and the inventor was Fabricio Bartoletti. Previously at the time of discovery, this lactose was suspected and identified as sugar by Carl Wilhelm Scheele in 1780. It is also important to know that when a newborn mammal and its mother feed it, the lactose is fully contained in the milk. Mammals use the enzyme lactase to make milk digested properly and this enzyme will split the lactose molecule into 2 parts, galactose and glucose which will eventually be absorbed by the intestines. The production of this digestive enzyme lactase will decrease as most mammals experience with age, and humans also experience this. Lactose intolerance is a condition that arises due to a person's inability to digest lactose (Vesa, 2000).

c. Fructose

Fructose (fructose, levulose), or fruit sugar, is a monosaccharide found in many types of plants and is one of the three important blood sugars along with glucose and galactose, which can be directly absorbed into the bloodstream during digestion. Fructose was discovered by the French chemist Augustin-Pierre Dubrunfaut in 1847. Pure fructose tastes very sweet, is white in color, is crystalline solid, and is very soluble in water. Fructose is found in plants, especially honey, fruit trees, flowers, berries and vegetables (Elliot, 2000). In plants, fructose can be a monosaccharide and/or as a component of sucrose. Sucrose is a disaccharide molecule which is a combination of one glucose molecule and one fructose molecule. Fructose is a polyhydroxyketone with 6 carbon atoms. Fructose is an isomer of glucose; both have the same molecular formula ($C_6H_{12}O_6$) but have different structures (Román-Leshkov, 2006).

2.5. Overview of Vegetable Food

Vegetable food is food made from fruit and vegetables. Vegetable foods are foods that contain high fiber so that the physical properties of plant foods are as follows:

a. Soft-textured vegetable foods, for example: vegetables and several types of fruits such as papaya, oranges, strawberries.

b. Hard-textured plant foods, for example: tubers, plant materials from stems, and several types of fruits such as pears, apples.
c. Vegetable food with a chewy, flexible and elastic texture, for example certain types of fruits.

Vegetable foods contain pigments which are the source of color for these foodstuffs. This pigment is naturally found in foodstuffs. Based on the pigment content, plant foods are divided into 7, namely:

Table 2. Types of plant food pigments

Pigment Type	**Color**
anthocyanins	Orange, red, blue
Flavonoid, antoxantin	colorless, yellow
leucoanthocyanins	Colorless
Tannins	Colorless, yellow
Betalain	yellow, red
quinone	Yellow to black
Xanthones	Yellow
Chlorophyll	Green, brown
Carotenoids	Colorless, yellow, red

III. Research Method

3.1. Time and Place

This research is planned to be carried out at the Hospitality Laboratory of Building K STIEPARI Semarang.

3.2. Materials and Tools

The use of materials in the research on making tomato dates was selected using fresh tomatoes of good quality, sugar, honey and milk.

The equipment used in the research of making tomato dates is using hygienic equipment and tools in good condition, including refrigerators, analytical scales, sealing, plastic containers, cabin dryers, plastic bags.

3.3. Research Implementation Procedure

The implementation of the research is the experimental steps of making tomato dates. This research begins with the following steps, namely:

a. Making Tomato Dates (performed by the Chairperson and Members of the Research Proposing)

Tomato flesh (150 g) was washed, then drained. After that, it was soaked with lime water with a concentration of 0.05% for ± 4 hours, then washed again and drained. After that, boil for ± 30 minutes with the addition of sugar, honey and milk according to the treatment to be used. Then stir for 5-10 minutes until the water is absorbed. Then it was rolled up and dried using a cabinet dryer for ±12 hours at 60ºC. Then it was packaged with 0.03 mm PP plastic.

b. Kinetic Observation of Quality Decline in Candied Tomatoes (conducted by the Chief Researcher)

Observation of the kinetics of deterioration in the quality of candied tomatoes using the Accelerated Shelf Life Test (ASLT) method of the Arrhenius model. Samples were stored at 3 different temperatures, namely 35ºC, 45ºC, 55ºC. Sample parameters were observed every 5 days for 25 days to get the rate of product damage based on the sensory quality of the product during storage as a critical parameter for decreasing the quality of candied tomatoes. Furthermore, the data obtained from the sensory test is averaged and then plotted in a graph of the relationship between time (x-axis) and the average sensory score at each storage temperature (y-axis).

c. Estimating the Shelf Life of Candied Tomatoes (performed by the Chief Researcher)

Determination of the shelf life of candied tomatoes was determined based on the sweets with the shortest shelf life among the sensory parameters. The formula for determining shelf life is as follows:

$$t = \frac{(A\ A0)}{K30}$$

$$t = \underline{\ln(A/A0)}$$

Where:
A = final score (rejected limit) score 1-5 with rejected limit at 3
A0 = starting score of day 0
t = shelf life of the product

d. Addition of Sugar (performed by Research Proposing Member)

The preservative added factor used in this study was candied tomatoes with the addition of preservatives in the form of glucose, lactose and fluctose and candied without preservatives as a control. The data obtained from the test will be analyzed one iteration for each sample and three repetitions of the analysis.

IV. Result and Discussion

4.1. Organoleptic Test

Code	Color Organoleptic Mean	Category
T0 (0% Sugar Tomato Dates)	4,21 $\pm$ 1,27	Likes
T1 (Tomato Dates 30% Sucrose)	4,28 $\pm$ 1,08	Likes
T2 Tomato Dates 30% Lactose)	4,58 $\pm$ 0,85	Very Like
T3 Tomato Dates 30% Fructose)	4,59 $\pm$ 0,93	Very Like

The results of the organoleptic acceptance analysis of the color of tomato dates with various treatments can be seen in the table above. Based on the organoleptic results (color) of tomato dates presented in the table, it shows that tomato dates with the addition of sugar as much as T0 (0% Tomato Dates 0% Sugar), T1 (Tomato Dates 30% Sucrose) both were still in the like category, while T2 Tomato Dates were 30% Lactose) and T3 Tomato Dates 30% Fructose) both were in the very like category. Panelists probably like tomato dates because of their yellow-brown color. Azari et al., (2010) added that, The role of sunlight plays a role in the formation of natural color in tomatoes, because it affects the metabolic pathways involved in pigment biosynthesis. The specificity of the light spectrum affects the pigments synthesized in tomatoes, thus playing an important role in aging save tomatoes. As another example, the relationship between red light and blue light has a significant effect on tomato pigmentation. Kader and Rolle (2004) and D'Souza et al. (2015) added that Tomatoes in the current postharvest process of work consist of three basic goals related to market acceptance, which include maintaining factors including 1) high commercial fruit quality (firmness, size and color); 2) high nutritional quality (lycopene, ascorbic acid, antioxidant activity and total phenol content); and 3) desired organoleptic properties (titratable acidity, pH, electrical conductivity and total dissolved solids) so as to achieve these objectives including optimizing temperature, relative humidity, oxygen and carbon dioxide concentrations in some cases, ethylene concentrations.

Code	**Fragrance Organoleptic Average**	**Category**
T0 (0% Sugar Tomato Dates)	3,78 $\pm$ 1,29	Likes
T1 (Tomato Dates 30% Sucrose)	3,96 $\pm$ 1,21	Likes
T2 Tomato Dates 30% Lactose)	4,45 $\pm$ 0,92	Like
T3 Tomato Dates 30% Fructose)	4,72 $\pm$ 0,72	Very Like

The results of the organoleptic acceptance analysis of the aroma of tomato dates with various treatments can be seen in the table above. Based on the organoleptic results (aroma) of tomato dates presented in the table, it shows that tomato dates with the addition of sugar as much as T0 (0% Tomato Dates 0% Sugar), T1 (Tomato Dates 30% Sucrose) and T2 (Tomato Dates 30% Lactose) are still in the category likes, while T3 Tomato Dates 30% Fructose) is in the very like category. Panelists may like tomato dates because of their unsightly aroma. The aroma of tomato dates will feel optimum when they are ripe because in aerobic conditions the sugar will be converted into CO2 and alcohol, causing it to mix with acid to produce esters which make the fruit aroma strong. Volatile compounds in tomatoes play a role in forming aroma and flavor. The components that make up the aroma and flavor are terpene hydrocarbons, carbonyl components, alcohols, and esters.

Code	**Category Sense Organoleptic**	**Category**
T0 (0% Sugar Tomato Dates)	2,95 $\pm$ 1,58	Somewhat Like
T1 (Tomato Dates 30% Sucrose)	3,48 $\pm$ 1,48	Somewhat Like
T2 Tomato Dates 30% Lactose)	4,34 $\pm$ 1,28	Like
T3 Tomato Dates 30% Fructose)	4,81 $\pm$ 0,82	Very Like

Based on the organoleptic results (taste) of tomato dates presented in the table, it shows that tomato dates T0 (0% Tomato Dates 0% Sugar) and T1 (Tomato Dates 30% Sucrose) where both are still in the moderately favorable category. While at T2 (30% Lactose Tomato Dates) showed liking, and T3 Tomato Dates 30% Fructose) showed very liking. The taste in the T3 treatment was preferred due to the tomato dates which increased the panelists' preference for taste. This is probably because the sweet taste of dates suppresses the bitter aftertaste of tomato dates. Ripe tomato dates have a slightly sour taste, while ripe fruit has a sweet taste that is still fresh. The sweet taste of overripe tomatoes is due to the fact that during the ripening process, the starch content in the fruit will turn into reducing sugars (Mishra et al., 2015).

Code	Texture Organoleptic Mean	Category
T0 (0% Sugar Tomato Dates)	2,95 ± 1,58	Like
T1 (Tomato Dates 30% Sucrose)	3,48 ± 1,48	Like
T2 Tomato Dates 30% Lactose)	4,34 ± 1,28	Like
T3 Tomato Dates 30% Fructose)	4,81 ± 0,82	Very Like

The table above shows that the texture of tomato dates with the formula T0 (0% Tomato Dates 0% Sugar), T1 (Tomato Dates 30% Sucrose) and T2 (30% Lactose Tomato Dates) has a smooth texture where all three fall into the preferred category. While the formula T3 Tomato Dates 30% Fructose) which shows the category of very like. The presence of sugar in tomato dates affects the texture of the dates. The pectin content of the fruit affects the texture of the product obtained, besides the type of fruit itself also affects the texture. The addition of sugar affects the formation of texture. The process of forming tomato texture occurs because of the bond between the polymer chains so as to form a 3-dimensional structure that contains solvent in the gap (Saxena et al., 2012).

4.2. Lactose Test

Treatment	Code	Result	Average Level (% mg)
Lactose 20 gr	Lactose 1.1	53,2	53,16
	Lactose 1.2	54,4	
	Lactose 1.3	51,9	
Lactose 30 gr	Lactose 2.1	70,3	73,73
	Lactose 2.2	78,4	
	Lactose 2.3	72,5	
Lactose 40 gr	Lactose 3.1	83,8	84
	Lactose 3.2	82,9	
	Lactose 3.3	85,3	

From the table above, it can be seen that the Lactose content contained in tomato dates with the addition of 20gr, 30gr and 40gr treatment resulted in the highest lactose content, namely the addition of 40gr lactose as much as 84% while the lowest lactose content was the addition of 20gr lactose as much as 20gr. The lower the level of lactose produced, the higher the activity of bacteria in breaking down lactose and vice versa. This is due to the reaction that lactose is a natural reducing sugar in foodstuffs. The addition of lactose used comes from cow's milk so the higher the concentration The milk that is fed the higher the percentage of lactose content. This statement is supported by (Siso et al., 1996) that the lactose utilization system is described in K. lactis and depends mainly on two genes namely LAC12 and LAC4. Lac12 is a membrane permease that imports lactose into cells, and Lac4 is an intracellular lactase (b-galactosidase) that hydrolyzes lactose into the monosaccharides glucose and galactose for easy catabolism. (Puricelli et al., 2019) added that the kinetics of lactose absorption by Lac12 and its hydrolysis by Lac4 can facilitate the possibility of fermentative growth occurring.

4.3. Sucrose Test

Treatment	Code	Result	Average Level (% mg)
Sucrose 20 gr	Sucrose 1.1	48,1	46,53
	Sucrose 1.2	47,3	
	Sucrose 1.3	44,2	
Sucrose 30 gr	Sucrose 2.1	61,5	62,9
	Sucrose 2.2	62,3	
	Sucrose 2.3	65,1	
Sucrose 40 gr	Sucrose 3.1	82,9	83,8
	Sucrose 3.2	83,2	
	Sucrose 3.3	85,3	

The increase in the amount of sucrose content in tomato dates can be seen with the increasing proportion of sucrose. The sucrose content in tomato dates comes from the sucrose sugar which acts as an osmotic agent and also from the reducing sugar content. The higher the concentration of sugar that enters the material, the greater the amount of sugar measured because sucrose as a non-reducing sugar, reducing sugar from fruit, and organic acids formed are counted as total sugar. This is because sucrose is included in the non-reducing sugar monosaccharide group. Sucrose is the main carbohydrate in tomatoes. It is produced in photosynthesis of source tissues, mainly into leaves and transported to fruit for fruit development and its phloem system (Zanon et al., 2014). Different treatment of sucrose can maintain high content, increase antioxidant capacity and increase postharvest nutritional value. Meanwhile, sucrose also induces anthocyanin accumulation by regulating the expression of genes involved in anthocyanin biosynthesis (Gao et al., 2018).

4.4. Fructose Test

Treatment	Code	Result	Average Level (% mg)
Fructose 20 gr	Fructose 1.1	48,1	46,53
	Fructose 1.2	47,3	
	Fructose 1.3	44,2	
Fructose 30 gr	Fructose 2.1	61,5	62,9
	Fructose 2.2	62,3	
	Fructose 2.3	65,1	
Fructose 40 gr	Fructose 3.1	82,9	83,8
	Fructose 3.2	83,2	
	Fructose 3.3	85,3	

Fructose which in its main function as a natural sweetener in fruit which can also provide nutrition to lactic acid bacteria optimally so that these bacteria are able to produce the right taste and not too sour due to the formation of lactic acid bacteria as a result of their metabolites, causing other combinations . The addition of ingredients containing carbohydrates when added to a product, the carbohydrate content will increase during the cooking process (Sartorelli et al., 2009). Variations in glucose and fructose content of some parts of the fruit such as skin and fruit pulp are indicated by the presence of the enzyme amylase which plays a role in sugar metabolism in tomatoes. Fructose in all parts of the fruit is caused by the hydrolysis of starch or starch by the enzyme amylase (Rambla et al., 1997).

4.5. Total Bacteria Test

Treatment	Code	Result	Treatment Code Average Level (% mg)
Total Bacteria 20 gr	Total Bacteria 1.1	28×10^7	$33{,}3 \times 10^7$
	Total Bacteria 1.2	32×10^7	
	Total Bacteria 1.3	40×10^7	
Total Bacteria 30 gr	Total Bacteria 2.1	120×10^7	142×10^7
	Total Bacteria 2.2	148×10^7	
	Total Bacteria 2.3	158×10^7	
Total Bacteria 40 gr	Total Bacteria 3.1	83×10^7	$85{,}6 \times 10^7$
	Total Bacteria 3.2	85×10^7	
	Total Bacteria 3.3	89×10^7	

From the table above, it can be seen that the highest increase in total bacteria was in the 30gr treatment. Total bacteria in this study can cause different sour taste differences in tomato dates. Sour taste indicates the activity of lactic acid bacteria in breaking down lactose to produce lactic acid. The increase in bacterial activity is due to materials that can be utilized by lactic acid bacteria (Barcenilla et al., 2021).

4.6. Antioxidant Activity Test

Code	Consentration	% Antioxidant Activity
Tomato Dates 1.1	30	26,77
Dates Tomato 1.2	60	42,45
Tomato Dates 1.3	90	58,71

The table above shows that antioxidant levels increased due to an increase in the proportion of different sucrose. The more sucrose is added, the greater the osmotic pressure, causing more water to be extracted from the material. The more water extracted from the material, the more water soluble components extracted from the material, but due to the addition of a high concentration of sucrose, the water fraction increased so that the antioxidant levels increased. Sugar and its degradation products are known to decrease the stability of anthocyanins. Sugar is reported to accelerate the degradation of anthocyanins as a result of sugar degradation products formed when acids and sugars are heated continuously together. The longer the storage time, the maximum anthocyanin pigment absorption shifted, indicating a change. High sugar concentrations and the presence of oxygen cause greater pigment damage (Drake et al., 2001).

V. Conclusion

Based on the results of the research, it can be concluded that the shelf life of tomatoes when treated with derivatives (glucose, lactose, fructose) on the shelf life of processed vegetable foods and their impact on shelf life is proven to be significant so that sugar can be used as an alternative in processing plant foods.

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