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The characteristics of Aloe vera gel as an edible coating

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Abstract. Preserving fruits using edible coating already long known. The edible coating serves to improve the appearance, as gas exchange barrier, retain moisture, antimicrobial and extend shelf life. The edible coating is widely used because it does not harm human health, can be eaten and biodegradable. One of the natural ingredients potentially as an edible coating is Aloe Vera leaf gel containing compounds such as polysaccharides, glucomannan, sugar reduction, tannins, organic acids, minerals, proteins. But the weakness is the gel that easily becomes diluted. The purpose of this research is to find out the best characteristics of Aloe vera gel as an edible coating that can be applied at the post-harvest handling of fruits. This study used a randomized complete design. From the results obtained that the gel is stored at cool temperatures are relatively stable, as seen from variable weights and water levels. The gel is stored at room temperature a little decline. The longer it is stored at room temperature, the moisture content of Aloe Vera gel. The gel is stored at cool temperatures increasing pH up to day 5 after it declined again. While the gel is stored at room temperature that is relatively stable at pH range 2.

1. Introduction

The development of the post-harvest handling of agricultural products in the world is increasingly developed and still developing. Some way has done among others with the use of low temperature, atmospheric modification, delivery of chemicals, coating wax, and edible coatings [1]. The edible coating is a thin layer of edible and easily definable natural (biodegradable), serves to prevent changes to the chemical, physical and biological. In addition, an edible coating can prevent mass displacement, as an additive, is a barrier against moisture and gas exchange of O_2 and CO_2 [2]. The edible coating gives the advantage that is some active ingredient can be incorporated into polymer matrices and can maintain the nutritional and sensory attributes [7].

The number of harmful preservatives causes concern in the community, because of the high risk of health. Some natural ingredients can be used as a preservative (edible coating) in particular on direct fruit is eaten without peeling his skin. Aloe Vera gel is a potential natural material that can be used as an edible coating because it consists of polysaccharides containing many functional components. The nature of antimicrobial and antioxidant ability of Aloe gel is able to inhibit the post-harvest damage [1][5]. Gel Aloe Vera can make such a layer of wax and easily applied. The disadvantage is the gel still unstable, easily become diluted due to the nature of the viscosity. If the gel is directly contacted with the air and light color, it will turn the color from pink to brownish [5], and arising unpleasant flavor. The Aloe Vera gel viscosity is decreasing the water viscosity drastically when stored at room temperature for 24 – 26 hours, this is due to hydrolysis of polysaccharides by an enzyme that still had high activity [6]. Based on this, the further research about treatment conditions and prolonged storage

against the stability of Aloe gel as an *edible coating* is needed. This research aim is to study the influence of storage conditions and the duration in the storage against the characteristics Aloe Vera gel as *an edible coating*.

2. Research methods

The Implementation of the research began in January to May 2018 in the laboratory of Agriculture Faculty Warmadewa University. The materials that are used are citrate acid, chlorine, and the leaves of the Aloe Vera is obtained from farmers in Taro Village District of Gianyar Bali Province. This study used a randomized complete design with two factors and two repetitions: Factor 1 is the storage conditions of the aloe vera gel which consists of T_1 (cold temperature) and T_2 (room temperature). Factor 2 is the treatment prolonged storage consisting of P_1 (1 day), P_2 (2 days), P_3 (3 days), P_4 (4 days), P_5 (5 days), P_6 (6 days), P_7 (7 days), P_8 (8 days). The treatment of the combination is obtained 32 experimental unit.

The Implementation of research is starting from processing the Aloe Vera gel. Optimation of leaching techniques to eliminate mucus is yellow (yellow zap) and odor that can degrade the quality of the gel. To prevent Aloe Vera leaf gel from being contaminated, it must be handled with care and soaked in chlorine which can reduce the number of microbes outside the leaves [4]. After that, the homogenization is carried out for 10 minutes. If the homogenization is carried out for too long, it will cause the browning reaction of enzymatic in Aloe Vera gel [3]. The next step is to do the Stabilization of gel Aloe Vera with a heating treatment at a temperature of 85° C for 5 minutes and the addition of citric acid 4%. High-Temperature Short Time (HTST) is an effective method to reduce odor and biological activity of Aloe Vera gel [3]. The observed parameters include changes in weight, water content, pH, color, and thickness. Followed by shelf life, to know the characteristic of Aloe Vera gel during storage at cold temperature and room temperature for 8 days. The parameters observed were the moisture content, pH, changes in weight, color, and viscosity. Data from the measurement results are statistically tested using BNT media processing with SPSS. The edible coating made from Aloe Vera Gel with the best formulations will be applied on fruits (different studies).

3. Result and discussion

3.1. Shrink weights

Based on the results of the research, the weighting of the gel Aloe Vera without warming up stored on cold temperatures are relatively constant. Because storage at cold temperatures causes the activation of enzymes to decrease so that the process of oxidation and breakdown of gel tissue is smaller, therefore the losing weight because of old storage can be avoided [3]. Gel without or with heating stored at room temperature slightly decreases. A drastic decrease was not seen in the gel with the treatment of heating stored in cold temperatures. Storage at room temperature affects the loss of some gel components due to evaporation. The results showed that the maximum stability of Aloe Vera polysaccharide gel at 70 ° C will decrease at higher or lower temperatures [3]. While weights gel wrote first heated and added citric acid and then stored at cool temperatures on the 6th day of storage dropped dramatically. The weighting of gel at different storage conditions and times is shown in Table 1.

3.2. Color

The results of research on visual colours were taken as shown in Table 2 and Table 3. Aloe Vera Gel without heating stored at room temperature on day 4 was brown, this was due to contact with oxygen so that the reaction became brown. Leaves that are processed shortly after harvest start decomposition of the gel degradation matrix, because the enzyme reaction is natural in the presence of oxygen [3]. Aloe Vera gel if exposed to air or light after two hours of extraction, the colour is pink and then it will become darker [6]. Colour has a relationship with the effectiveness and stability of the gel. Some products psychologically users cannot accept colour changes. In the future, a simple but efficient

processing process needs to be developed. Aloe Vera gel by heating in an open container stored at room temperature changes colour faster than the gel stored at cold temperatures. If Aloe Vera gel contact with oxygen at room temperature will stimulate the colour change process [6]. Supported by the opinion [11] that the colour changes to brown to sorrel, sometimes grey or yellow. Brown colour occurs due to carbohydrate oxidation by the peroxidase enzyme and catalase. Browning reactions depend on oxygen levels and pH can be prevented by heating.

Table 1. the shrink weights of aloe vera gel at different storage conditions

Day	Gel without heating (gr)		Gel with heating (gr)	
	Room	Cold	Room	Cold
1	4, 093	4, 420	4, 380	4, 780
2	4, 093	4, 434	4, 354	4, 778
3	3, 993	4, 488	4, 325	4, 763
4	3, 942	4, 433	4, 271	4, 747
5	3, 863	4, 408	4, 146	4, 746
6	3, 794	4, 369	4, 083	2, 725
7	3, 620	4, 371	3, 997	1, 596
8	3, 603	4, 367	3, 283	0, 799

Table 2. The color of Aloe Vera gel without heating at different conditions

Day	Gel without heating (gr)	
	Room temperature	Cold temperature
1	Transparent white	Transparent white
2	Transparent white	Transparent white
3	Pink	Pink
4	Brown	Pink
5	Brown	Pink
6	Brown	Pink
7	Brown	Pink Fade
8	Brown	Yellow

Table 3. Colors of Aloe Vera gel with heating at different conditions

Day	The gel in an open container		The gel in a closed container	
	Room	Cold	Room	Cold
1	Transparent white	Transparent white	Transparent white	Transparent white
2	Transparent white	Transparent white	Transparent white	Transparent white
3	White Fade	White Fade	Transparent white	Transparent white
4	Yellow	Yellow	Transparent white	Transparent white
5	Yellow Fade	Yellow Fade	Yellow Fade	Yellow Fade
6	Yellow Fade	Yellow Fade	Yellow Fade	Yellow Fade
7	Yellow Fade	Yellow Fade	Yellow Fade	Yellow Fade
8	Yellow Fade	Yellow Fade	Yellow Fade	Yellow Fade

3.3. The degree of acidity (pH)

The degree acidity of the gel which stored at room temperature is relatively stable, while stored at cold temperatures is increased (Table 4). An increased amount of acid during storage is caused by the activity of the microorganisms which can convert carbohydrates into acids [12]. Hydroxyl carboxylic

polysaccharides undergo ionization reaction from -COOH became^{-} -COO and H^{+} [10]. A decrease in pH values causes a decrease in the level of viscosity. Viscosity is a measure of the relative to the movement of the fluid resistance of the parts.

Table 4. The Degree of Acidity Aloe Vera Gel on the conditions and Long Storage Different.

Day	Gel	
	Room temperature	Cold temperatures
1	2.04	2.00
2	2.03	2.11
3	2.04	2.16
4	2.18	4.05
5	2.09	3.86
6	2.00	5.13
7	2.00	3.93
8	2.04	6.79

3.4. Viscosity

The results of the research on the viscosity are taken as shown in Tables 5 and 6. The purpose of heating at 80°C is to reduce or suppress active phenolase which greatly affects the Aloe Vera gel physicochemical. From table 5 it can be seen that longer heating results in greater gel viscosity. This is because the heating time causes more water to evaporate. The water in the gel is mechanically immobilized. Gel has variations in the level of hardness, elasticity, and fragility. It depends on the gelling agents, salinity, pH and temperature. Aloe Vera gel is very unstable and easily influenced by air, light, heat, and microbes [13]. The longer the storage the greater the possibility of fluid coming out of the three-dimensional structure of the gel. The liquefaction gel involves crosslinking which involves the dismantling of the carbohydrate polymer chain [10]. Most polysaccharides have a reactive functional group forming carboxylates [9]. Gel stored at cold temperatures also decreases activity, even though the loss of activity is getting lower. Loss of activity caused by enzymatic activity after the leaves are separated from the tree. This means that even if stored at cold temperatures will also cause biological activity to decrease.

Table 5. Viscosity at the different time of heating

Heating (minutes)	Viscosity (cp)
0	275
5	397
10	448

Table 6. Viscosity at different storage

Day	Viscosity (cp)
1	394.8
2	376.7
3	290.1
4	221.3
5	105.5
6	69.0
7	30.4
8	28.8

3.5. Moisture

The results of the study of water content retrieved data as shown in Table 7. Aloe Vera gel is comprised of 99.5% water and solid materials (0.5 – 1%) which contain a variety of compounds including the compound that is soluble in water and fat, vitamins, minerals, enzymes, polysaccharides, phenolic compounds and organic acids [5]. The moisture of gel which is deposited at room temperature tends to increase until day 3 and dropped back on day 4. While the gel is stored at cool temperatures prevail instead.

Table 7. Moisture on the different conditions.

Day	Gel	
	Room temperature	Cold temperature
1	95.05	98.37
2	99.66	96.08
3	99.46	96.36
4	94.79	98.12
5	95.13	99.03
6	96.95	99.56
7	94.84	99.48
8	95.08	99.35

4. Conclusion

The conclusions of this research are Aloe vera gel with heating and stored at cold temperatures until day 5 relatively stable, as seen from the variables shrink weight, color, pH, viscosity and moisture content. While the gel is stored at room temperature decline started day 2. Aloe Vera gel should be stored at cool temperatures with a sealed container. The best characteristics of Aloe Vera gel as an edible coating that can be applied at the post-harvest handling of fruits.

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