

Fig. 9 Total soluble solid of zalacca coating at different chitosan concentration and stored at 15°C

From Figure 8 and 9 shows that the total of soluble solid was fluctuate during storage. The decreasing of the soluble solids was caused by respiration process which makes the sugar being reduction to be pyruvates acid and produces CO₂ and H₂O. According to Wills et al [11] reported that in the process of ripeness, the solidity is hydrolysed to be sucrose and changed to be a sugar reduction as the substance in the process of respiration. The general prone that occurs during the storage by increasing of sugar content and then it comes to the decreasing. The changing of that sugar follows the patterns of fruit respiration. Therefore, the amount of soluble solid is fluctuate during storage.

Four fruit stored at room temperature, treatment A1B0 (room temperature, concentration 0%) the total was 17⁰Brix–20⁰Brix and had shelf life for 10 days. Treatment A1B1 (room temperature, concentration 0.5%) the total solid was 16⁰Brix -21⁰Brix and had shelf life for 12 days. For treatment A1B2 (room temperature, concentration 1%) the total of solid was 16⁰Brix -19⁰Brix and had shelf life for 10 days. Treatment A1B3 (room temperature, concentration 1.5%) the total was 17⁰Brix –20⁰ Brix and had shelf life for 11 days.

On other hand, for fruit stored at 15°C, the treatment A2B0 (temperature 15°C, concentration 0%) the total was 17⁰Brix –21⁰Brix and had shelf life for 15 days. For treatment A2B1 (temperature 15°C, concentration 0,5%) the total was 17⁰Brix –21⁰Brix and had shelf life for 24 days. The treatment A2B2 (temperature 15°C, concentration 1%) the total of solid was 17⁰Brix–21⁰Brix and had shelf life for 17 days. At the treatment A2B3 (temperature 15°C, concentration 1,5%) the total was 17⁰Brix –22⁰Brix and had shelf life for 17 days.

From our result, there are differences in total soluble solid of coating zalacca during storage between treated and untreated fruit. Similar result was also found from coating of fresh cut mango which the edible coating had difference in total soluble solid competed with control [10]. Based on our observation the best chitosan concentration to maintain sugar content of zalacca was 0.5% and 1.5%. The amount of soluble solid was continued with statistics analysis of anova to determine the effect of temperature and chitosan concentration. The result shows in Table 4.

TABLE IV
ANALYSIS VARIAN OF TOTAL SOLUBLE SOLID OF ZALACCA

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Conclusion
Concentration of Chitosan	4,334	3	1,445	3,416	0,043	*
Temperature	3,151	1	3,151	7,451	0,015	*
Concentration of Chitosan × Temperature	0,503	3	0,168	0,396	0,757	NS
Error	6,766	16	0,423			
Total	14,753	23				

Explanation : NS = Not Different
* = Different as well

The result in the Table 4 shows that the storage temperature affected to total soluble solid. The best temperature for storage of coating zalacca was 15°C because stored at this temperature prolonged the shelf life than stored at room temperature. The result of analysis Duncan of chitosan concentration toward TPT shows in Table 5.

TABLE V
DUNCAN TO DETERMINE EFFECT OF CHITOSAN CONCENTRATION

Concentration of Chitosan	N	Subset Alpha = 0,05	
		1	2
B0	6	18,44533	
B2	6	19,22800	19,22800
B3	6		19,43067
B1	6		19,52567
Sig		0,053	0,464

Based on Table 5 at the column 1 shows that the effect of chitosan concentration to the total of soluble solid 1% (B2) was not different because it had significant values at 0.053. At column 2, shows that concentration 1% (B2), concentration 1.5% (B3) and concentration 0.5% (B1) had different values at 0.464, then it can be concluded that at the colom 2, the highest values was the best way to maintain the total of solidity at zalacca. The best concentration for coating zalacca was 0.5% (B1) which zalaccas could be stored for 24 days at 15°C and 12 days at room temperature.

E. Vitamin C

The amount of vitamin C at the fruit can be measured as the total of ascorbat acid. Generally, the content of vitamin C during the storing gets lowering. According to Ministry of Health Republic Indonesia [12], the value of vitamin C at zalacca at 100 g is 2 mg or the same as 0,2%.

A graphic about the decreasing of vitamin C during the storing is shown in figure 10 and 11.

Based on figure 10 and 11, generally, the value of vitamin C at zalacca in the first storing at room temperature or 15°Ctemperature toward the chitosan concentration at each of the treatment until it finished decreased. However, storage at room temperature was faster in decreasing vitamin C compared to the storing at cold temperature. It was caused by the cold temperature retards the rate of respiration. This condition will cause the change of ascorbate acid to be slowed, then vitamin C will be easy to get damaged if it gets

sun ray. The result of observation of vitamin C at zalacca at cold temperature prone to be stable.

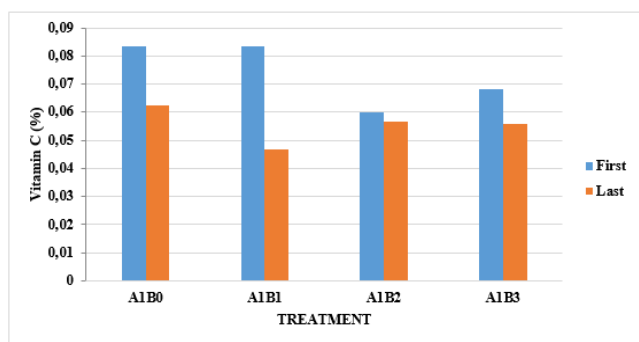


Fig. 10 Vitamin C of Zalacca coating at different chitosan concentration and stored at room temperature

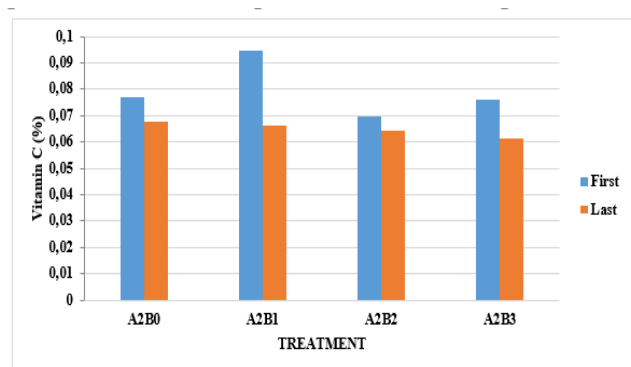


Fig. 11 Vitamin C of Zalacca coating at different chitosan concentration and stored at 15°C.

At the treatment A1B0 (room temperature, concentration 0%) had the value of vitamin C at the first storing about 0.083% and decreased on the end of storage to be 0.062%. At the treatment A1B1 (room temperature, concentration 0,5%) had the value of vitamin C on the first storing about 0.083% and decreased on the end of storing to be 0.047%. At the treatment A1B1 (room temperature, concentration 1%) had the value of vitamin C at the first storing about 0.059% and decreased at the end of storage to be 0.057%. At the treatment A1B3 (room temperature, concentration 1,5%) had the value of vitamin C at the first storing about 0,068% and decreased at the end of storing to be 0.05%.

At the treatment A2B0 (temperature 15⁰C, concentration 0%) had the value of vitamin C at the first storing about 0.077% and decreased at the end of storing to be 0.068%. At the treatment A2B1 (temperature 15⁰C, concentration 0,5%) had the value of vitamin C at the first storing about 0.095% decreased at the end of storing to be 0.066%. At the treatment A2B2 (temperature 15⁰C, concentration 1%) had value of vitamin C at the first storing about 0.069% and decreased at the end of storing to be 0,064%. At the treatment A2B3 (temperature 15⁰C, concentration 1,5%) had value of vitamin C at the first storing about 0.076% and decreased at the end of storing to be 0.061%.

The degree of vitamin C at room temperature at 15 °C was lower of chitosan layer at 1% and 1,5%. It was caused by chitosan layer with concentration can impede the process of respiration at zalacca which affect the damage process of one compound in the fruit. According to Wills et al [11]

prone to have a low vitamin C during storage was caused by organic acid where ascorbate acid had a cracking cell and it becomes the simple compound due to the process of respiration. The result of the observation vitamin C of zalacca continued with statistic testing of anova analysis to see the influence of temperature and chitosan concentration. The result shows in Table 6.

TABLE VI
ANOVA ANALYSIS OF VITAMIN C AT ZALACCA DURING ITS STORING

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Conclusion
Concentration of Chitosan	0,000	3	0,000	0,279	0,840	NS
Temperature	0,001	1	0,001	1,567	0,229	NS
Concentration of Chitosan × Temperature	0,001	3	0,000	0,495	0,691	NS
Error	0,006	16	0,000			
Total	0,008	23				

Explanation : NS = Not Different

Based on the Table 6 for the testing of temperature and chitosan concentration influences toward the content of vitamin C at the fruit shows that the variable at chitosan concentration had significant value about 0.840 and it indicated that H_0 was accepted and it means that the chitosan concentration was not different toward vitamin C and the damaged of zalacca. The variable of temperature had a significant value about 0.229 or bigger than 0.05 or H_0 was accepted and it means that the stored temperature was not different toward vitamin C at the damaged of zalacca.

F. Organoleptic Experiment

Organoleptic testing for 10 panellists were aroma, texture, color and taste at each of the treatment. Organoleptic testing was conducted by storage the fruit until cannot consume. The assessment had range from 1-5 with 1(very dislike), 2 (dislike), 3(so-so), 4 (like), and 5 (very like). The result of the assessment of all panellists was averaged where the average was 4.50-5.00 means very like 3.50-4.49, like 2.60-3.49, so-so 1.60-2.50, and dislike 1.00-1.50. The color of the skin was one of the parameters to decide before buying. The skin color at zalacca was browning yellow with brightness at the pole. The colour that liked by panellists was a brightness of fruit, no wrinkle and there was no black spot of damaging.

The result of organoleptic toward skin color during the storage shows in figure 12 and 13.

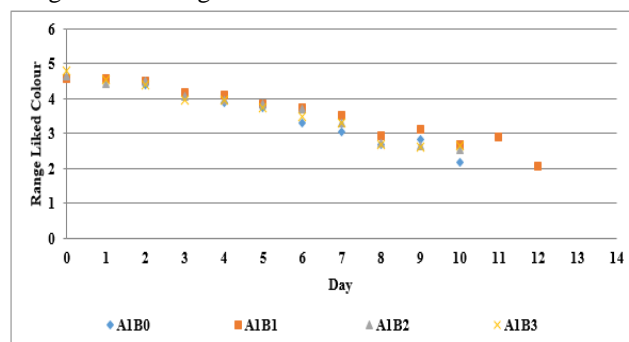


Fig. 12. The Level of panelist' fondness to the color of Zalacca coating at different chitosan concentration and stored at room temperature

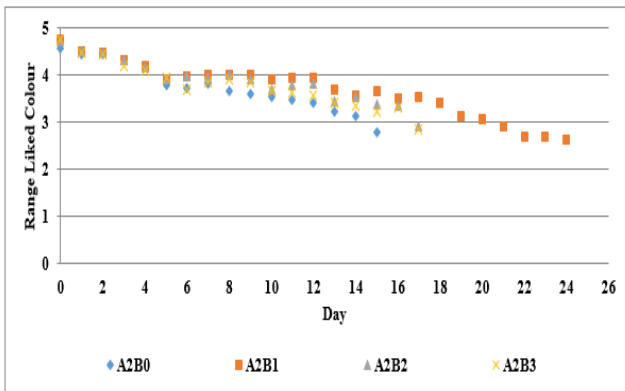


Fig. 13. The Level of panelist' fondness to the color of zalacca coating at different chitosan concentration and stored at 15°C.

Based on the Figure 12 shows that the level of fondness toward the color at room temperature at the first day until the 6th day still liked by the panellists .It can be seen at the value 4-5 which means that the color still be liked as well. At the 7th day, the level of panellist' fondness toward the color decreased about 3-3.5 that means that they did not like it. At room temperature, the panellist' fondness for the color decreased where zalacca without chitosan layer 1.5% and 1%. It shows that the lowest value of decreasing came from chitosan 0.5%.

The value of panellist fondness for the color at cold temperature was decreased. In figure 13, it shown that at the first day until 11th the panellists still like the color and then did not come the next day. The level of fondness was significant on the treatment without chitosan layer, then 1,5% and 1%. The smallest treatment of layer decreased in the color. It was shown on the 13th day at the value 4.

The shrinking of fruit influenced the color of zalacca. It was caused by respiration, the shrinking fruit that occurred on the fruit. The damaged of zalacca' skin was indicated with the growing of white mold, then it could not be consumed. The damaged of the skin at 15⁰C was indicated by the crack and the wrinkle of the skin as showed in the figure 14.

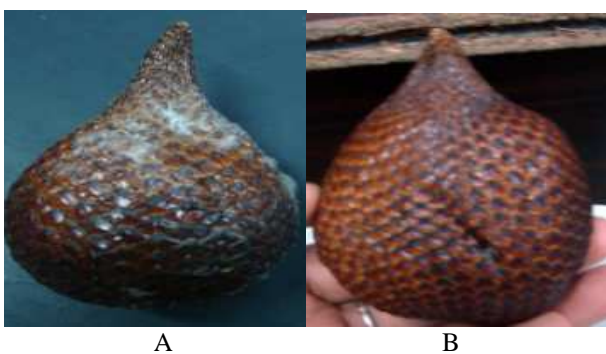


Fig. 14 (A) Zalacca' Skin at Room Temperature, (B) Zalacca' Skin at 15°C Temperature

The color, aroma, zalacca also was evaluated by organoleptic. From aroma the quality of fruit could be determined. The charismatic aroma of zalacca without other aroma was like by panellist. The values of panellist' fondness toward the aroma of zalacca in each day was decreased. The decreasing shows in the figure15 and 16.

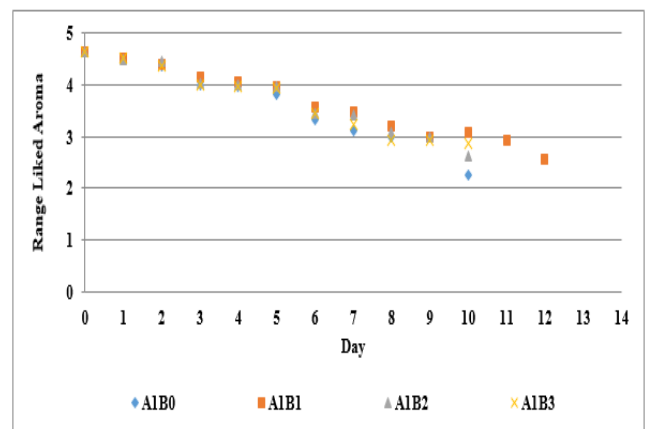


Fig. 15. A graphic of Panelist' Fondness to the Aroma of Zalacca coating at different chitosan concentration and stored at room temperature

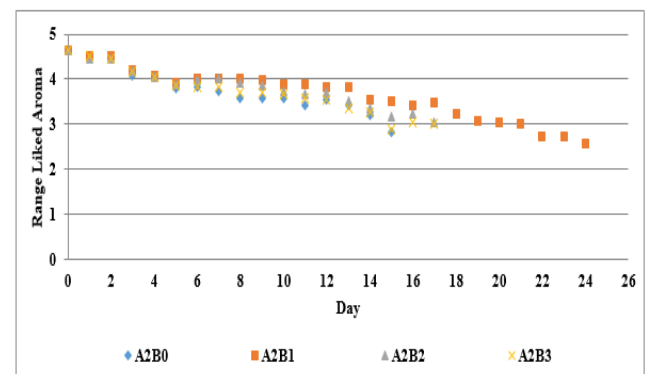


Fig. 16. A Graphic of Panelist'Fondness to the Aroma of of zalacca coating at different chitosan concentration and stored at 15°C.

Based on the figure 15 shows that the room temperature had values on panellist fondness on the aroma of zalacca where fruit could be stored until 6 days for each treatment. The highest decreasing value of the level of aroma fondness was found on zalacca without the treatment about 2.27. While at chitosan layer 1.5% and 1% decreased of aroma fondness on the 10th. At 1% chitosan the value was about 2.63 meanwhile at 1.5% was about 2.87%. Chitosan layer 0.5% at the first storage had aroma about 4.63 and at the end of storage had 2.57 and extended the self life for 12 days.

The level of panellist fondness toward the aroma of zalacca at cold temperature shows in figure 16. At the 20th days until 14th, the panellist was like the aroma. The significant value of decreasing of aroma was on the treatment without chitosan layer, then at 1.5% and 1% chitosan. From the graph, the treatment of chitosan layer 0,5% slightly decreased of the aroma. It was shown at the treatment of panellist fondness which exists on 14th in 3,9 had shelf life for 24 days.

The texture was also assessed in organoleptic test. The texture affected the quality. For long storage, the zalacca had the bad of the quality and continued to damaged which had soft texture and flesh produced the water. The hard texture indicates that the fruit could be consumed. The decreasing of its texture was shown in figure 17 and 18.

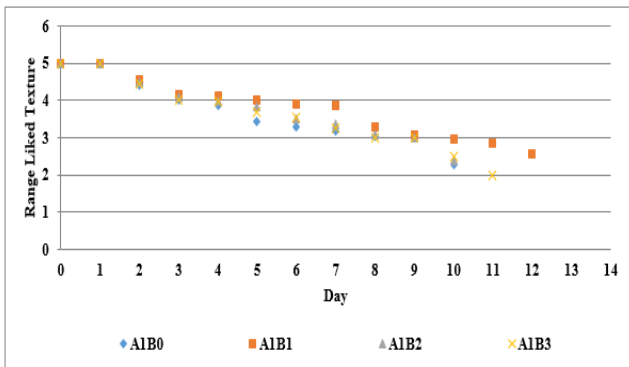


Fig. 17. A Graphic of the level of panelist' fondness to texture of zalacca coating at different chitosan concentration and stored at room temperature

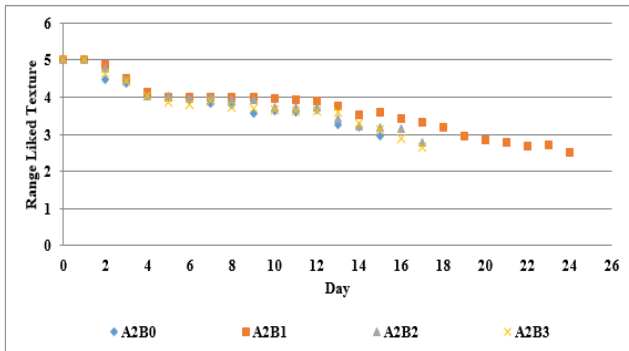


Fig. 18. A Graphic of the panelist' pondness to the texture of of zalacca coating at different chitosan concentration and stored at 15°C.

Based on figure 17 and 18 it can be seen that the texture of zalacca has decreasing with its long storing. The decreasing happened at room storing and cold area. The values of fondness of zalacca texture at the first day until 7th day still are liked by the panellist with the value 4 and 5. The significant decreasing of the fondness toward the texture will happen at the treatment without chitosan layer and has a life storing during 10 days. The decreasing of the fondness toward the texture also happened at 1,5% and 1% layer meanwhile at 0,5% it has a small decreasing which can maintain during 12 days. The level of panellist' fondness toward the texture also gets decreasing. At the first day until 14th, the panellist still likes the texture of zalacca.

However, for the next day, the level of fondness which gets decreasing comes to be 'like'. The significant level of fondness which gets decreasing is at the treatment without chitosan and at 1,5% and 1% layer. If we see at the graphic, the treatment of chitosan layer 0,5% has decreasing of the texture, it can be seen at the treatment where the value of panellist fondness maintains at 14th day is at 3,9 and has a life storing during 24 days. The decreasing of panellist' fondness is caused by the crispy of the fruit. The softness of the fruit is caused by the cracking of proto pectin which become pectin which is soluble in the water or it happens due to the hydrolysis, fat, or lignin [13]. The decreasing of its texture is also caused by the process of transpiration which loose its water and it can be seen at the shrink of the fruit and the wrinkle of its texture.

Taste is one of the parameter which affects the acceptance of consumer toward the product. The taste of zalacca is dominated by the mixing of sugar and acid. A graphic of panellist' fondness toward the taste of zalacca can be seen at figure 19 and 20.

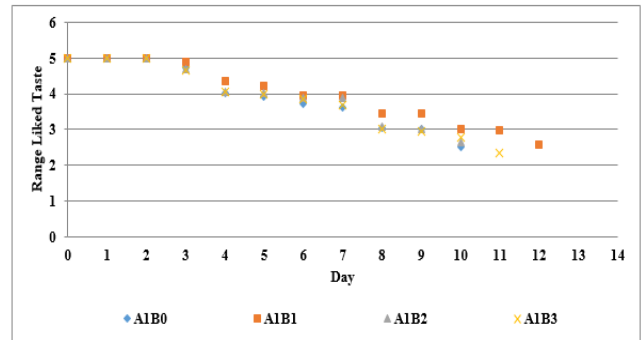


Fig. 19. A Graphic of panelist' fondness to taste of zalacca coating at different chitosan concentration and stored at room temperature

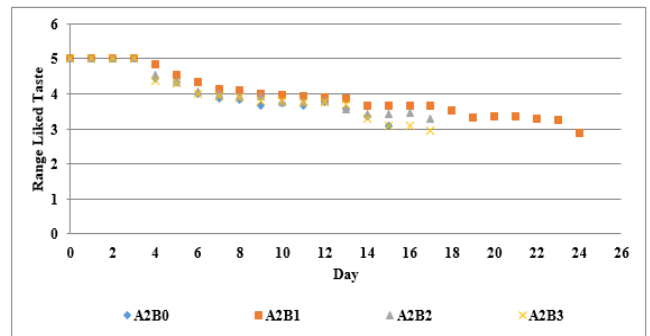


Fig. 20. A Graphic of panelist' pondness to taste of of zalacca coating at different chitosan concentration and stored at 15°C.

Based on the figure 19 shows that the room temperature storage of zalacca was accepted on the 8th day. For the next day, the taste value decreased by the panellists. The significant value decreased quality for the treatment without layer then came from chitosan 1,5% and 1%. Chitosan veneering 0,5% had small value, it shows that it could maintain the quality of the fruits until it was stored on the 12th day. Based on figure 21, show that the storage of zalacca at cold temperature did not decrease the quality of zalacca. Chitosan veneering 0,5% maintained quality until 14th day which had value 4-5. Then for the next day, the level of panellist's fondness decreased about 3-3.8. At layer concentration 0,5%, zalacca had a long life during 24 day. And without its layer, it only maintained until 9th day.

Based on the observation, the value of fondness decreased day by day. This was caused by the content of the water in the fruit, then the lowering chemical substance like vitamin C and sugar during the storing. The taste of zalacca was influenced by the amount of solid solubility, amount of acid, and other compounds from the process of metabolism.

The lowering level of panellist fondness toward the taste of zalacca was caused by the tasteless and a bit of sour taste of zalacca. An insipid taste was caused by the amount of acid in the fruit where its sweetness being low.

IV. CONCLUSIONS

Based on the result of the research, we concluded: Concentration of chitosan affects to total of soluble solid of zalacca, but it did affect to weight loss, hardness, content of the water, and vitamin C. Storage temperature influenced the total of soluble solid in zalacca, but it did not affect to weight loss, hardness, content of the water, and vitamin C.

The best concentration of chitosan was at 0.5% which stored at 15⁰C of room temperature because on this condition can extend the shelf life of fruit for 24 days. Zalacca without coating had a short shelf-life time around 15 days stored at the temperature 15⁰C and 10 days at room temperature.

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