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RESEARCH ARTICLE

The Differences Color Intensity, pH, Absorbance Value of Frangipani (*Plumeria accuminata* Ait) Sap During Storage

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ABSTRACT:
Manipulation of alveolar bone remodeling process to accelerate tooth movement in the use of orthodontic appliances may be supported by natural ingredients, one of which is frangipani sap (*Plumeria accuminata ait*). The harvest of frangipani sap is completely influenced by the limited time to collect and the little amount of frangipani sap that may be taken. These difficulties cause the harvest of frangipani sap should be done gradually and must be stored first before harvest the next frangipani sap. This study aimed at determining the effect of storage duration on the quality of frangipani sap. The frangipani sap was examined by color intensity, pH and photometry tests using a wavelength of 450nm and 630nm to observe changes in the quality of frangipani sap. The results of the two test measurements were carried out in serial time and compared using statistical analysis. The results showed that both the pH and photometric tests showed changes in value over storage duration, of which the value on day 10 was not different statistically significant. Based on these results it is concluded that frangipani sap has good quality until the day 10 of storage.

KEYWORDS: Color Intensity, pH, Absorbance, frangipani sap, storage.

INTRODUCTION:
The use of orthodontic appliances to correct malocclusion involves the process of alveolar bone remodeling. The process is stimulated using the mechanical force of the activation of the appliance components applied to press the teeth and continued to the surrounding tissues of the teeth including the gingivae, periodontal ligaments and alveolar bone[1,2,3].

The process of alveolar bone remodeling to move the teeth in direction to the expected place is a process that takes a long time and requires visits for repeated activation of the instrument and frequently results in pain and discomfort causing most patients to be uncooperative and not continue the treatment that has been conducted[4]. This condition leads some researchers to try to manipulate the alveolar bone remodeling process in order to accelerate the process. One method of manipulation is the use of herbal ingredients that have properties and may become a material in manipulating alveolar bone remodeling[5,6].

Frangipani (Plumeria sp.) is a plant that may be a maydidate in manipulating alveolar bone remodeling. Utilization of Plumeria species in orthodontic tooth

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movement was carried out by Wangidjaja[7] using sap and leaves from *Plumeria alba*. The study demonstrates that the sap and the flowers of frangipani (Plumeria Alba) contain a mixture of bioactive compounds that have the ability to facilitate movement/shift and have antibacterial properties and non-toxic to cells.

The harvest of frangipani sap should consider the time of harvest that is very limited. It is ideally conducted early in the morning before the sun rises until around 7 a.m. In addition, the other difficulty is that the amount of frangipani sap obtained is very little and maynot be collected in proper amount in one harvest time. These difficulties cause frangipani sap to be collected gradually and must be stored first before collecting the next frangipani sap.

This study aimed at determining the effect of storage duration on the frangipani sap quality.

MATERIALS AND METHODS:

The Harvest of Frangipani Sap:

The sap was collected from frangipani plant species of *Plumeria acuminata ait*. The plants were previously registered at the Plant Taxonomy Laboratory of the Biology Department, Faculty of Mathematics and Natural Sciences, Universitas Brawijaya by showing the examples of flowers, leaves and photos of the trees. The criteria for frangipani plants used were (1) growing in the area of Jember Regency or its surroundings, and (2) aged enough marked with brown bark with a minimum trunk circumference of 45cm measured on the part which was 100cm from the ground.

The harvest of frangipani sap (tapping frangipani sap) was adopted from the method for tapping rubber plants and other gummy woody plants with modifications. The harvest was performed at 04.00 - 06.00 am. The sap was harvested from a frangipani trunk part which was 120 cm from the ground. The sap harvest method was combined by cutting tree trunks about 50cm from the end of the trunks. The sap coming out from the tree trunk was stored using a container made of glass. The sap was subsequently filtered to be free from dirt, and the glass container is tightly closed to avoid sunlight and moisture. During storage, the sap was stored in a glass container and put in iced boxes, and placed in a refrigerator at 4°C.

frangipani sap quality Assay:

Frangipani sap was placed on 9 small glass bottles in accordance with the number of groups, the division of the group based on the length of the day the sap would be tested. Examination of each group was carried out by color intensity, pH test and photometric test.

Color Intensity tests:

The frangipani sap taken from the refrigerator and placed at temperature room and stirred. The picture of frangipani sap was taken with a DSLR camera (Nikon D7200, Nikon AF-S NIKKOR 85mm f/3.5G ED DX VR Micro Lens, Ring flash) according to the day specified in the same hour. The measurements of color intensity were performed on frangipani sap images in 3 different regions using the ImageJ 1.52i software (Wayne Rasband National Institute of Health, USA) and the results were all averaged.

pH test:

The pH test was carried out by means of a research sample in the form of frangipani sap taken from the refrigerator and placed at temperature room and stirred. Tip pH meter (BOECO Germany pH METER BT-600) was included in the frangipani sap and digitally read.

Photometry test:

Photometric test were carried out by means of a study sample in the form of frangipani sap taken from the refrigerator and placed at temperature room and stirred. Frangipani sap was photometrically examined using a UV-VIS spectrophotometer (BOECO Germany Spectrophotometer model S-220 U / VIS) using two different wavelengths of 450nm and 630nm. The reading result was the absorbance value.

Statistic test:

The parametric examination results of the control and treatment tests were analyzed statistically using the IBM SPSS 23 program with a significance level of 0.05 ($p = 0.05$) and a reliability level of 95% ($\alpha = 0.05$).

RESULT:

The frangipani sap that has been taken and photographed has a milky white color. Frangipani sap color can be seen in figure 1.

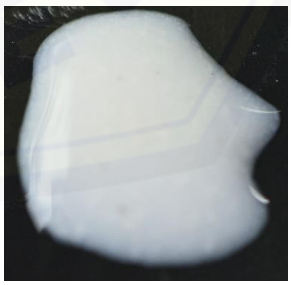

Figure 1: Frangipani sap (taken with Nikon D7200 DSLR camera)

Various frangipani sap groups were tested for color intensity, pH and photometry, the photometric test was carried out at wavelengths of 450 nm and 630 nm. The results of the three tests are presented in Figure 2, 3, 4 and 5.

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The Result of color intensity test:
The results of color intensity test are presented in Figure 2.

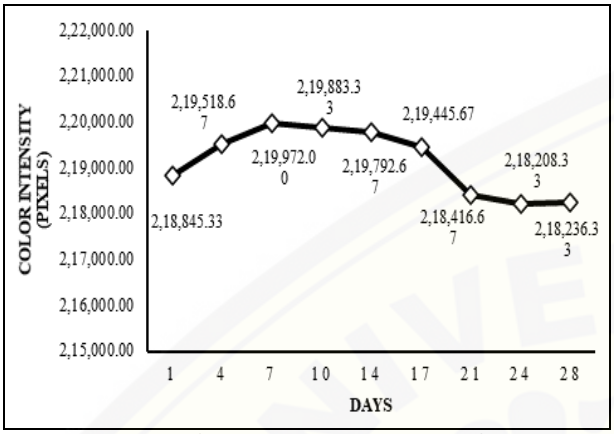


Figure 2: Results of color intensity on various frangipani sap groups

Description:

◊ The values was not statistically significant different when compared to group day 1

Figure 2 shows that in color intensity test, lowest value in group day 24 was 218,208.33, the highest value in group day 7 was 219,883.33. This results also shows that there was a same value tendency of color intensity with the length of storage duration. Based on the results of the statistical tests performed, the results of measuring the color intensity value in various groups was not have a statistically significant different.

The Result of pH test:
The results of pH test are presented in Figure 3.

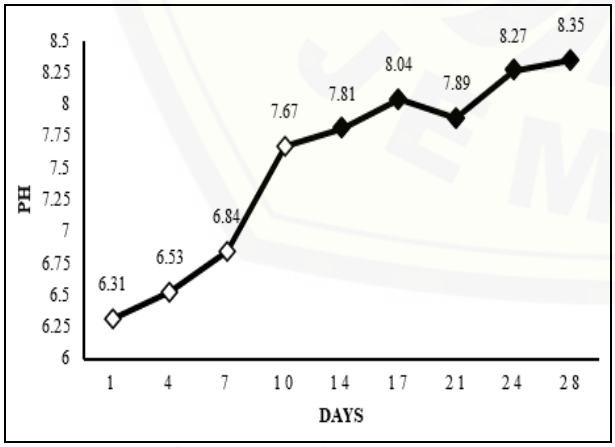


Figure 3. Results of pH on various frangipani sap groups

Description:

♦ The values was not statistically significant different when compared to group day 1

◊ The values was statistically significant different when compared to group day 1

Figure 3 shows that in pH test, the lowest pH value in group day 1 is 6.31, the highest value in group day 28 was 8.35. This results also shows that there was a tendency of increased value of pH test with the length of storage duration. Based on the results of the statistical tests performed, the results of measuring pH value up to 10 days (group day 10) has values that are not significantly different from the results of the first day (group day 10).

The Result of Photometry test:
The results of photometry test are presented in Figure 4a (wavelength of 450 nm) and Figure 4b (wavelength of 630 nm).

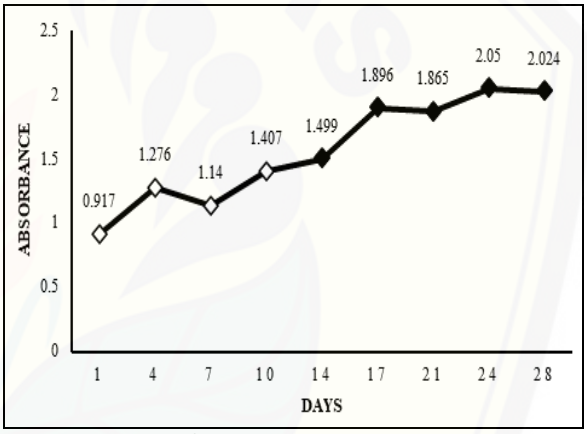
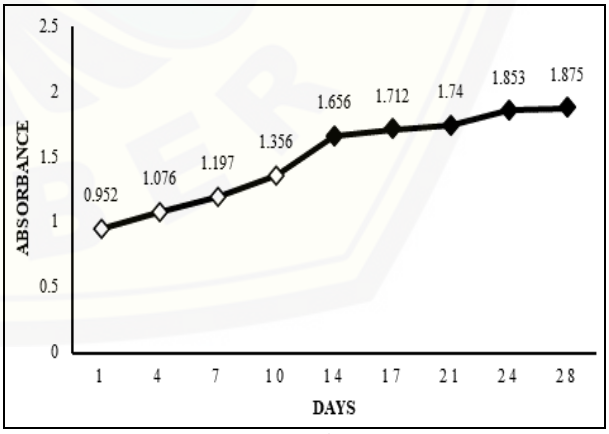


Figure 4: (a)Results of photometry test 450 nm wave length



(b) 630 nm wave length) on various frangipani sap groups

Description:

♦ The values was not statistically significant different when compared to group day 1

◊ The values was statistically significant different when compared to group day 1

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Figure 4a shows that in photometry test using wavelength 450nm, the lowest absorbance value in group day 1 is 0.917, the highest value in group day 24 was 2.05. This results also shows that there was a tendency of increased value of photometry test with the length of storage duration. Based on the results of the statistical tests performed, the results of measuring absorbance value up to 10 days (group day 10) has values that are not significantly different from the results of the first day (group day 10).

Figure 4b shows that in photometry test using wavelength 630nm, the lowest absorbance value in group day 1 is 0.952, the highest value in group day 28 was 1.875. This results also shows that there was a tendency of increased value of photometry test with the length of storage duration. Based on the results of the statistical tests performed, the results of measuring absorbance value up to 10 days (group day 10) has values that are not significantly different from the results of the first day (group day 10).

DISCUSSION:

The results of this study (Figure 3 and 4) showed that storage duration may affect the quality of frangipani sap through pH and photometric tests in which figure shows the change in pH value and absorbance along with the duration of storage. When compared to the pH value and absorbance at the measurement of the first day, the storage duration for 10 days shows a value that statistically is not significantly different. Ali et al[8] reported that In the process of storage must be closed or exposed to outside air and in cold temperatures (4°C) and in containers that are sun proof. This was to protect the oxidation process which in turn will also affect the condition of the sap itself. The oxidation process showed the presence of oxygen atoms that react with the isoprene poly chain to form poly isoprene peroxide which is getting long periods.

There are three parameters that show the polarity of a solvent i.e. dipole moment, dielectric constant and solubility in water. Molecules of solvents with large dipole moments and high dielectric constants are polar. Water is the most polar solvent with a dielectric constant of 80, with the variation of pH in the water solvent used, the water polarity little decreases thus it may extract not only polar compounds[9,10].

The longer frangipani sap is stored the thicker it is due to the condensation process, the ingredients contained, therefore when the photometer is tested, the absorbance increases with the duration of the storage time. This is in line with the research of Marzuki et al[11] which states that the increase in absorbance may be caused by an increase in the concentration of active ingredients contained in an extract.

The increased concentration of sap was also possible due to the occurrence of a clumping process that naturally occurs in the sap produced from gummy plants in general. Ristianingsih et al[12] which states that the Clumping naturally can occur due to the activity of decomposing bacteria in the air and into sap material. New fresh sap tapped from rubber trees is one medium that is suitable for bacterial growth. This bacterial growth occurs in the medium of the sap trees skin vessels. Bacteria begin to enter sap since sap flows along slices tapping and multiplying throughout the media. The main food substances for these bacteria are carbohydrates contained in the serum sap fraction. In the presence of oxygen in the air, carbohydrates can be converted into bacteria into acetic acid and formic acid. This process can cause sap to clot

The spectrophotometer produces light from the spectrum with a certain wavelength, and the photometer is a measuring device for the intensity of the transmitted or absorbed light. If radiation or white light is passed through a colored solution, radiation with a certain wavelength will be absorbed selectively and other radiation will be transmitted. Absorbance is the ratio of the intensity of the light absorbed to the intensity of the incoming light. This absorbance value will depend on the content of the substances in which contained, the more levels of substances contained in a sample, the more molecules that will absorb light at certain wavelengths thus the absorbance value is greater or in other words the absorbance value will be directly proportional to the concentration substances contained in a sample[13,14].

Other studies state that storage of sap is not recommended for a long time. To maintain the quality of sap during storage, the level of moisture content should be reduced thus it will minimize other unnecessary chemical substances during storage. Non-enzymatic browning reactions on a product are accelerated in conditions of high level of moisture content[15].

This research is obviously still a basic, further research is needed to observe the chemical content of frangipani sap on the time series and also to observe if the chemical content is still good or not when stored for a certain time.

CONCLUSION:

It may be concluded that frangipani sap stored at 4°C has a pH value and absorbance (photometric results) that statistically are not significantly different until 10 days of storage, thus the researchers recommend that

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frangipani sap should be treated before 10 days of storage.

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CONFLICT OF INTEREST:
The authors declare no conflict of interest.

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