

## Effect of Duration of Heat Cured Acrylic Resin Plates in Granule Dental Cleaning Materials Effervescent Effect of Cocoa Pod(*Theobroma C*) 6,5 % Little Extracts on Color Stability

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**Objective:** To determine the effect of duration of heat cured acrylic resin plates in granule dental cleaning material effervescent effect of cocoa pod(*Theobroma Cacao L*) 6,5% little extracts on color stability. **Materials and Method:** The reasearch methode use was True experimental laboratory pretest-posttest only with control group research design. **Results:** the results of the effect of duration immersion of the L value where the time of immersion was 10 minutes, 15 minutes, and 20 minutes the p-value was 0.768. The results of the effect of duration immersion of the A value where the duration immersion was 10 minutes, 15 minutes, and 20 minutes the p-value was 0.117. The results of the effect of duration immersion of the B value where the time of immersion was 10 minutes, 15 minutes, and 20 minutes the *p-value* was 0.173. The results of comparison of duration immerson of heat cured acrylic resin plates before and after immersion of the effervescent granule extract of cocoa peels (*Theobroma Cacao L*) based on the CIE LAB value where the time of immersion is 10 minutes, 15 minutes and 20 minutes *p-value* 0.325. **Conclusion:** No influence and does not appear to significantly influence color stability. This shows the effectiveness of stable color absorption as a denture cleaning ingredients.

**Keyword:** acrylic resin plates, *granule effervescent*, *Cocoa pod(Theobroma Cacao L)*, color stability.

### Introduction

The community's need for oral health is increasing marked by the need for making artificial teeth. acrylic resin is one of the material for making dentures. Acrylic resins have been known for a long time as materials formaking dentures in the field of dentistry. Ninety-five percent of the base denture used ismethacrylate monomer and polymethyl methacrylate polymer which is polymerized by heating.<sup>[1],[2]</sup>

One of the ways to treat dentures is to immersion them in denture cleaners that contain disinfecting solutions. On the market many various forms of denture cleansers include paste, tablets and liquid. One denture cleaner that can be used in the form of granules effervescent. Granules Effervescent are granule products or coarse to very coarse powder that contain medicinal elements in a dry mixture, usually consisting of sodium carbonate, carbonic acid and tartart acid. This mixture when added to water, acids and carbonates will react and release carbon dioxide which produces froth. To use must be according to the

manufacturer's instruction. The Acrylic resin plates immersion by effervescent denture cleaning in a continuous period of time can change the color.<sup>[3],[4]</sup>

Based on preliminary research conducted states that the temperature of 20-25°C and duration immersion of 15 minutes can inhibit the growth of streptococcus mutans and candida albicans with a concentration of 6.5% in a denture cleaning agent granule effervescent extract of cocoa skin (*Theobroma Cacao L*).

The color change is caused by two factors there are intrinsic and extrinsic. The intrinsic factor is the chemical change in the material itself, which is the imperfect polymerization process. While extrinsic factors are stain due to absorption of coloring agents from exogenous sources such as tea, coffee, soft drinks, nicotine and mouth rinses. Both of these factors cause the occurrence of chemical-physical reactions that occur is the absorption of the attachment of dye particles on the surface of the resin and the absorption of the attachment that enters into the interior through porosity. Concentration and duration of exposure to stain in drinks can affect resin pigmentation. Besides the value of the color change can be influenced by other factors including oral hygiene, water absorption and imperfect polymerization process.<sup>[5]</sup>

Based on research about the color change in acrylic resin is very much, among others, Evan et al., In 2015 stated that there was a color degradation of acrylic denture base after the use of rosella denture cleaning paste. The duration immersion interval was determined based on several studies which stated that 10 minutes was effective in killing fungi and bacteria on the denture plate. Another study by Jordan et al, in 2014 stated that the comparison of acrylic color changes after immersion in a 15-minute kkklorexidine solution and effervescent (alkaline peroxide) for 5 minutes showed a change in color but not very visually apparent. The selection of immersion time is determined based on several studies that use immersion time of 5, 10, 15 minutes. According to Rajeev grag research, in 2011 stated that the effectiveness of denture cleaning agents when used can kill microorganisms reaching 99% in immersion for 10-20 minutes.<sup>[5],[6],[7]</sup>

Cocoa skin (*Theobroma Cacao L*), is a plant that is known to have anti-bacterial and anti-fungal properties. Evidenced by the results of a study conducted by Yumas (2017) extracts of waste skin from cocoa beans are bacteriostatic against Streptococcus mutans. According to Fowler (2009), the content of polyphenols in cocoa is responsible for color, gives a sense of taste in the mouth and has antioxidant benefits. Fresh cocoa beans contain purple pigment, which is anthocyanidin which will be oxidized by polyphenol oxidase to quinon during the fermentation process of cocoa beans. Quinon can form complexes with amino acids and proteins and polymerize with flavonoids to form tannins. The tannins form complexes with proteins through hydrogen bonds to produce brown water-insoluble pigments that give cocoa its distinctive color.<sup>[8],[9],[10]</sup>

The color contained in the extract of the cacao skin (*Theobroma Cacao L*) allows the color change in the base of the denture. For this reason, the researchers wanted to examine whether there was an effect of duration immersion of the heat cured acrylic resin in the cleanser material of granule effervescent denture cacao skin (*Theobroma Cacao L*) extract on color stability.

## Material And Methods

The type of research used in this study is a true experimental laboratory with a pretest-posttest only with control group design. The sample used is rectangular heat cured acrylic resin plates with length = 20 mm, width = 10 mm, and thickness = 2 mm. There are 8 samples for 3 groups, so there are 24 samples in total. Measurement of color changes is carried out in the Prosthodontics Dentist Education Program Laboratory.

The production of heat cured acrylic resin plates was carried out at Dental Laboratory Muslim University of Indonesia with the following procedure, the red night samples were made as the main model with a long diameter is 20 mm, 10 mm wide and 2 mm thick by 24 units. Mix dental plaster and water then stir until homogeneous, after homogeneous, the mixture is put in a cuvette. The wax is placed on the dental plaster mixture which will start to harden in the cuvette with a flat surface with the dough. Let stand until the dental plaster hardens. The surface of the dental plaster is smeared with vaselin and the top cuvette is mounted then filled with dental plaster mixture.

The surface of the dental plaster is smeared with vaselin and the top cuvette is mounted then filled with full dental plaster mixture. After setting the cast, the wax is removed by immersion the cuvette in hot water, then the cuvette is opened and the wax left behind is discarded. After drying, apply cold mould seal.

The polymer and monomer are stirred in a ceramic glass in a ratio of 3: 1 to reach the dough stage. The dough is put into the master mold, then pressed so that the dough flows out. The cover is opened, the excess is cut then closed and then pressed again. Conventional curing is done, according to the instructions on the material label, which starts at room temperature 72° for 90 minutes then left to 100°C for 30 minutes then allowed to cool. The excess acrylic is trimmed with minidrill, using a freezer bur, red stone, fissure bur and smoothed with sandpaper, then glaze the acrylic surface with filtcone, pumice and water then puree using a brush. Wash acrylic with water to remove impurities then immersion them in aquades for 48 hours to remove residual monomers and achieve high levels of saturation.

Furthermore, the samples were treated by dividing into 3 groups, 8 samples for each groups immersion for 10 minutes, 8 samples for groups immersion for 15 minutes, and 8 samples for groups immersion for 20 minutes in a solution of granule effervescent cacao skin extract. Get out the sample and cleaned with water then placed on a dry tissue at a temperature of 20-25 °C then the sample is ready to be tested for color stability.

Data processing by measuring color stability using a series of colorimeter devices. Measurements were made on samples before and after immersion in a solution of granular effervescent cocoa skin (*Theobroma Cacao L*) extract for 10 minutes, 15 minutes and 20 minutes. The Color changes are detected using the Commission Internationale de L'Eclairage (CIELAB) recommended by the American Dental Association (ADA). The color change of each sample is calculated by the standard formula as follows<sup>[11]</sup>

$$\Delta E^*_{ab} = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{1/2}$$

$$\Delta L^* = L^*_0 - L^*_t$$

$$\Delta a^* = a^*_0 - a^*_t$$

$$\Delta b^* = b^*_0 - b^*_t$$

Information :

- $\Delta E^*ab$  = color change value
- L = bright color coordinates
- a = red / green color coordinates
- b = blue / yellow color coordinates
- $L^*0, a^*0, b^*0$  = numbers after immersion
- $L^*t, a^*t, b^*t$  = numbers before immersion

The normality test is carried out using the Kolmogorov Sminov test and the Shapiro-Wilk test to determine the distribution and homogeneity of the data. Furthermore, the data analysis was performed by statistical testing using the Anova One Way test and then continued with the Paired T-test to find out which groups were significantly different using a 95% confidence level ( $\alpha = 0.05$ ).

## Result

The results of a comparative study of the color change of heat cured acrylic base denture immersion in the granule effervescent denture cocoa Skin (*Theobroma Cacao L*) extract for 10 minutes, 15 minutes and 20 minutes. Can be seen in the table as follows:

Table 1 Effect of duration immersion of 10 minutes, 15 minutes and 20 minutes on heat cured acrylic resin plates before and after immersion of granule effervescent cacao skin (*Theobroma Cacao L*) extracts on color changes in the value of L (white).

Duration Immersion	Average L Value Before Immersion	Average L Value After Immersion	P-Value
10 minutes	50,514	50,299	<b>0,768</b>
15 Minutes	50,769	50,669	
20 Minutes	50,825	51,194	

Table 1 shows that the average value of L (white color) in the 10 minute immersion group decreased from 50,514 to 50,299. The 15 minute immersion group decreased from 50,769 before immersion to 50,669 after immersion. Furthermore, in the 20 minute immersion group the average value of L increased from 50,825 before immersion to 51,194 after immersion.

Paired T-test results are statistical tests to determine the effect of the L length (white color) before and after immersion, showing a p-value of 0.768. This means that  $p > 0.05$  or no significant effect between the average color value of L (white color) before and after the deepening of acrylic resin into a denture granule effervescent ingredients of cacao skin (*Theobroma Cacao L*) extract.

Table 2 Effect of duration immersion of 10 minutes, 15 minutes and 20 minutes on the heat cured acrylic resin plates before and after immersion of granule effervescent cocoa skin (*Theobroma Cacao L*) extract on the color changes of A (Red / Green)

<b>Duration Immersion</b>	<b>Average A Value Before Immersion</b>	<b>Average A Value After Immersion</b>	<b>P-Value</b>
10 Minutes	20,063	19,906	<b>0,117</b>
15 Minutes	20,225	19,920	
20 Minutes	20,445	20,308	

Table 2 shows that the average value of A (red/green) in the 10-minute immersion group decreased from 20,063 to 19.906. And in the 15 minute immersion group, the average value of color A (red/green) decreased from 20,225 before immersion to 19,920 after immersion. Furthermore, in the 20 minute immersion group the average value of A (red/green) also decreased from 20,445 before immersion, to 20,308 after immersion. Overall the average value of color A (red/green) decreased in all immersion treatments.

Paired T-test results are statistical tests to determine the effect of the old A (red/green) before and after immersion, showing a p-value of 0.117. This means that  $P > 0.05$  or there is no significant difference between the average color value of A (red/green) before and after immersion of acrylic resin into a denture cleanser material of granule effervescent denture cocoa skin (*Theobroma Cacao L*) extract.

Table3 Effect of duration immersion of 10 minutes, 15 minutes and 20 minutes on heat cured acrylic resin plates before and after immersion of granule effervescent cocoa skin (*Theobroma Cacao L*) extract on the color change of B (Yellow/Blue)

<b>Duration Immersion</b>	<b>Average B Value Before Immersion</b>	<b>Average B Value After Immersion</b>	<b>P-value</b>
10 Minutes	5,776	5,884	<b>0,173</b>
15 Minutes	5,931	6,019	
20 Minutes	6,049	6,050	

Table3 shows that the average value of B (yellow / blue) in the 10 minute immersion group increased from 5.776 to 5.884. And in the 15 minute immersion group, the average value of color B (yellow / blue) increased from 5,931 before immersion to 6,019 after immersion. Furthermore, in the 20 minute immersion group the average value of B (yellow / blue) also increased from 6.049 before immersion, to 6.050 after immersion. Overall the average color value of B (yellow/blue) increased in all immersion treatments

Paired T-test results are statistical tests to determine the effect of the old B (yellow / blue) value before and after immersion, showing a p-value of 0.173. This means that  $P > 0.05$  or there is no significant difference between the average color value of B before and after deepening of acrylic resin into denture granule effervescent denture of cocoa skin (*Theobroma Cacao L*) extract.

Tabel 4 Comparison of immersion time of 10 minutes, 15 minutes and 20 minutes on a heat cured acrylic resin plate before and after immersion of granule effervescent cocoa skin (*Theobroma Cacao L*) extract on changes in the value of CIE LAB

<b>Duration Immersion</b>	<b>Average Color Changes CIE LAB</b>	<b>P-value ANOVA</b>
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10 Minutes	0,604	
15 Minutes	0,899	0,325
20 Minutes	1,164	

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Table4 shows that the average value of CIE L\* a\* b color change in the 10 minute immersion group is 0.604. And in the 15 minute immersion group, the average value of CIE L\*a\*b color change was 0.899. Furthermore, in the 20 minute immersion group the mean CIE L\*a\*b color change was 1,164. Overall, it can be said that the longer the immersion period, the greater the average value of CIE L\*a\*b color produced.

Then ANOVA one way statistical test was performed to see the significance of the difference in CIE L \* a \* b values in each immersion group. Anova One Way test was chosen because the immersion group numbered more than two groups or three immersion groups. Based on the ANOVA one way statistical test, the p-value was 0.325 ( $P > 0.05$ ). This means that there is no significant difference in the color change of CIE L\*a\*b between all immersion groups, both immersion 10 minutes, 15 minutes and 20 minutes.

## Discussion

This research was conducted in March 2020 at the Dental Laboratory of Muslim University of Indonesia and the PPDGS KPS Laboratory of Prosthodontics, Faculty of Dentistry, University of Hassanuddin with the aim of investigating the effect of immersion heat cured acrylic resin plates in the cleanser material of granule effervescent denture cocoa skin (*Theobroma Cacao L*) extract on color stability.

One of the ways to treat dentures is immersion them in denture cleaners that contain a disinfectant solution. One of the denture cleaners that can be used is granules effervescent. *Granule effervescent* are granules or coarse to very coarse powder products that contain medicinal ingredients in a dry mixture, usually consisting of sodium carbonate, carbonic acid and tartic acid.<sup>[11]</sup>

This study used heat cured acrylic resin plates consisting of 3 treatment groups, namely group A with immersion for 10 minutes, group B with immersion for 15 minutes, and group C with immersion for 20 minutes. Each immersion group amounted to 8 samples. So that the total sample in this study amounted to 24 samples.

This study also uses Anova One Way, Paired t-Test to determine the color change ratio between all acrylic resin plates before immersion and after immersion.

This research was conducted to prove that cleanser material granule effervescent denture cocoa skin (*Theobroma Cacao L*) extract can influence the immersion time of heat cured acrylic resin plates on color stability. The advantages of granula effervescent is have stability from liquid preparations, suitable for medicinal ingredients with large doses of ingredients, the rate of dissolution is faster than tablet or capsule preparations as well as the content owned by cocoa skin (*Theobroma Cacao L*) which has phenolic compounds, flavonoids, tannins, and terpenoids are known to have antimicrobial activity. As explained

by Yumas (2017) in his research said the extract of waste skin from cocoa beans is bacteriostatic against *Streptococcus mutans*. In addition, the study of Fowler (2009) also concluded that the content of polyphenolic classes in cocoa is responsible for color, gives a sense of sepat in the mouth and has benefits as an antioxidant.<sup>[8],[12]</sup>

The explanation can be seen that the granule effervescent denture cleanser of cocoa skin (*Theobroma Cacao L*) extract has the potential to be used as an immersion material on a heat cured acrylic resin plate on color stability. In accordance with research Syamsul & Supomo (2014) which states that effervescent powder is preferred because it has an attractive color, odor and taste. Additionally, compared to ordinary powdered drinks, effervescent powder has the advantage of being able to produce carbon dioxide gas which gives a fresh taste like soda water.<sup>[13]</sup>

Table 1 The results of the average L value on the heat cured acrylic resin plate was carried out before and after immersion of the granule effervescent cocoa skin (*Theobroma Cacao L*) extract on the heat cured acrylic resin for 10 minutes, the average L value decreased from 50,514 to 50,229. In the 15 minute immersion group decreased from 50,769 before soaking to 50,669 after immersion. Furthermore, in the 20 minute immersion group the average value of L increased from 50,825 before immersion to 51,194 after immersion.

The results of the Paired T-Test are statistical tests to determine the effect of the L (white) value before and after immersion in the 10 minute immersion group, the 15 minute immersion group and the 20 minute immersion group, showing a p-value of 0.768. This means that  $P > 0.05$  or there is no significant color difference between the average color of L before and after immersion of acrylic resin into a denture cleanser granule effervescent cocoa skin (*Theobroma Cacao L*) extract.

Table 2 The results of the average A value on the heat cured acrylic resin plate was carried out before and after immersion of the granule effervescent cocoa skin (*Theobroma Cacao L*) extract showed that immersion for 10 minutes obtained an average value of A decreased from 20,063 to 19,906. In the 15 minute immersion group, the average value of color A decreased from 20,225 before immersion to 19,920 after immersion. Furthermore, in the 20 minute group immersion, the average value of A also decreased before immersion from 20,445 to 20,308 after immersion. Overall the average color value of A decreased in all immersion treatments.

The results of the Paired T-Test are statistical tests to determine the effect of the length of the A value before and after immersion, showing a p-value of 0.117. This means that  $P > 0.05$  or there is no significant difference between the average color value of color A before and after immersion of acrylic resin into a denture granule effervescent cocoa skin (*Theobroma Cacao L*) extract.

Table 3 The results of the average value of B on the heat cured acrylic resin plate before and after immersion of the granule effervescent cocoa skin (*Theobroma Cacao L*) extract which showed after immersion on the heat cured acrylic resin for 10 minutes the average value of B increased from 5,776 to 5,884. In the 15 minute immersion group, the average color value of B increased from 5,931 before immersion to 6,019 after immersion. Furthermore, in the 20 minute immersion group the mean value of B also increased from 6.049 before immersion, to 6.050 after immersion. Overall the average color value of B increased in all immersion treatments.

Paired T-Test Test results are statistical tests to determine the significance of color differences before and after immersion, showing a p-value of 0.173. This means that  $P > 0.05$  or there is no significant difference between the average color value of B before and after immersion of acrylic resin into a denture granule effervescent cocoa skin (*Theobroma Cacao L*) extract.

Table 4 The results of a comparison of the average color of the CIE LAB value on the heat cured acrylic resin plate before and after immersion of the granule effervescent cocoa skin extract (*Theobroma Cacao L*) extract which shows that immersion in the heat cured acrylic resin for 10 minutes, 15 minutes and 20 minutes, into the effervescent granule denture cleanser exposed to the skin of cocoa (*Theobroma Cacao L*), which was then carried out an average measurement of CIE LAB before and after immersion. The results obtained were the average value of CIE L \* a \* b color change before and after immersion of heat cured acrylic resin into a denture granule effervescent cocoa skin (*Theobroma Cacao L*) extract. In the 10 minute immersion group that is equal to 0.604. In the 15 minute immersion group, the mean CIE L \* a \* b color change was 0.899. Furthermore, in the 20-minute immersion group the average CIE L \* a \* b color change was 1,164. Overall, it can be said that the longer the immersion, the greater the CIE L \* a \* b color change produced.

ANOVA One Way statistical test to see the significance of the difference in CIE L \* a \* b values in each immersion group. Based on the ANOVA one way statistical test, the p-value was 0.325 ( $P > 0.05$ ). This means that there is no significant difference in the color change of CIE L \* a \* b between all immersion groups, whether immersion 10 minutes, 15 minutes and 20 minutes.

Determination of the L\*, a\*, and b\* values using the CIELab system using a colorimeter tool did experience a slight change but it was not significant this was influenced by the length of the duration immersion which required a longer time or a time that was more than 10 minutes, 15 minutes and 20 minutes.

Table 4 can be concluded that the most stable immersion duration in color change is 10 minutes while the immersion length which has the biggest change from before and after is 20 minutes duration immersion.

This study also in line with research conducted by Yordan, et al (2014) states that the comparison of acrylic color changes after immersion in chlorhexidine solution for 15 minutes and effervescent (alkaline peroxide) and for 5 minutes showed a change in color but not very visible visually.<sup>[14]</sup>

The results of the study are also almost same as the results of research conducted by Adelia (2018) with the research title "Effect of acrylic plate brushing after immersion in effervescent sargassum polycitrum 2.5% granules for color degradation" which states that based on determining the value of L\*, a\* , and b\* using the CIELab system using a sample colorimeter does indeed increase or decrease in color changes with increasing duration immersion, but when seen clinically there is no color change and this is evidenced by statistical tests which also show no difference in comparison significant color changes from the samples in each treatment group.<sup>[15]</sup>

The results of the study also same with the results of research conducted by Irsan Ibrahim (2016) states that from the research that has been done, the results show that chlorhexidine solution can affect the color change heat cured acrylic resin when immersed

for 30 minutes to 45 minutes, it is proven that there is a significant chroma change that causes the color of the heat cured acrylic resin to fade. Chroma is defined as saturation, intensity and strength. [16], [17], [18], [19], [20], [21]

The research can be seen that in the immersion group of 10 minutes, 15 minutes, and 20 minutes, each color change did not appear significantly. However, this study showed that the acrylic resin plates before and after immersion in the granule effervescent denture cleanser cocoa skin (*Theobroma Cacao L*) extract occurred in the duration immersion of 10 minutes, while the greatest changes occurred in the duration immersion of 20 minutes.

This research is a preliminary study or a new study conducted by looking at a number of natural material references previously studied which have similarities to see the color stability.

Weaknesses in this research process after immersion is rinsed under running water which does not carry out in a container filled with water, where the acrylic resin will certainly affect discoloration.

### **Conclusion**

Comparison of duration immersion of 10 minutes, 15 minutes, and 20 minutes of heat cured acrylic resin plates in a granule effervescent cocoa skin (*Theobroma Cacao L*) extract to the color stability of CIE LAB shows that the longer immersion the greater the color change produced. Color stability on the acrylic resin plates before and after immersion in the granule effervescent denture cleanser cocoa skin (*Theobroma Cacao L*) extract occurred in the duration immersion of 10 minutes, while the greatest changes occurred in the duration immersion of 20 minutes.

### **Suggestion**

1. For further researchers, it is better to use more than 15 minutes to see the effectiveness of discoloration and inhibit bacterial growth.
2. For further researchers, it is better to compare the natural ingredients in the market with the natural ingredients studied by researchers, that is cocoa skin (*Theobroma Cacao L*) extract.
3. For further researchers after doing the immersion process in denture cleanser it should be rinsed under running water because it affects discoloration.

### **REFERENCES**

1. Naini A. The effects of various beverages to resin acrylic colors. Stomagtonatic- Journal The effects of various beverages to resin acrylic colors. Stomagtonatic dentistry.Unej. 2011; 8(2)
2. Diansari V, Fitriyani S, Haridhi FM. Study of residual monomer release of heat cured acrylic resin after soaking in distilled water. Cakradonya Dent J. 2016; 8(1): 1–7
3. David, D., & Munadzirroh, E.The color changes of acrylic resins denture base material which are immersed in Sodium hypochlorite and chlorhexidine. Dental Journal (Dentistry Magazine). 2006; 38(1): 36
4. Kailaku S, Sumangat J, Hernani nFN. Formulation of Antioxidant-Rich Effervescent Granules from Gambir Leaf Extract, 2012; 9(1): 27–34.
5. Kangsudarmanto, Yordan, dkk. Comparison of Color Change Heat Cured Acrylic Denture Base The Soaked In Khlrorhexidine and effervescent (Alkaline peoxide). DENTINO. 2014. Vol II, No. 2 Hal 205-209.

6. Setiana, Irfan Hadi. Arif Satria Wira Kusuma. Effervescent Granule Formulation of Various Plants. *Journal Review. Farmaka*. 2014. Vol 16. No.13.
7. Grag, R. Denture Hygiene, different strategies. *WebmedCentral DENTISTRY* 2010: 10(1). WMC 00932
8. Yumas, Media. Leather Waste Utilization Ari Cacao Beans (*Theobroma cacao* L) as a Source of Antibacterial *Streptococcus mutans*. *Central Plantation Plantation Industry*. 2017. Vol.12, No. 2
9. Kumalasari, E dan Sulistyani, N. Antifungal Activity of Ethanol Extracts Stem Binahong (*Anredera cordifolia* (Tenore) Steen). Screening against *Candida albicans* and phytochemicals. *Pharmaceutical Scientific Journal*. 2011. Vol 1, No. 2 : Hal: 59-60
10. Afoakwa, EO, Quao J, Takrama, FS, Budu, AS, Saalia, FK. Changes in total polyphenols, o-diphenols and anthocyanin concentrations during fermentation of pulp preconditioned Cocoa (*Theobroma cacao*) beans. *International Food Research Journal*. 2012. 19(3): 1071-1077
11. Annusavice KJ. Phillip's: Materials science textbooks dentistry. 10<sup>th</sup> ed. 10., Jakarta: EGC, 2004.
12. Kayaputri. IL, Sumanti, DM, Djali, M., Indiarso, R., & Dewi, DL. Skin Extract Phytochemical studies Cacao Beans (*Theobroma cacao* L).
13. Syamsul, E.S & Supomo. Effervescent Powder Formulation Water Extract of Tiwai Onion Bulbs (*Eleuterine Palmifolia*) As A Health Drink. *Traditional Medicine Journal*. 2014. Volume 19 (3), pp.113-114
14. Yordan, dkk. Comparison of Color Changes in Denture Acrylic-Based Heat Cured were soaked in chlorhexidine and Effervescent (Alkaline Peroxide). *DENTINO*. 2014. Vol II, No. 2 Hal 205-209
15. Adelia. Brushing influence Plate Acrylic After Soaking In *Sargassum Polycystum* Effervescent Granules 2.5% against color degradation. Thesis. *Journal of Dentistry Prosthodontics Unhas*. 2018
16. Ibrahim Irsan, dkk. Effect of Soaking Time in Chlorhexidine Solution on Changes in Heat Cured Acrylic Resin. *JMKG*. 2016. 5(1):7-14
17. Achmad H, Djais AJ, Petrenko EG, Larisa V, Putra AP. 3-d printing as a tool for applying biotechnologies in modern medicine. *International Journal of Pharmaceutical Research*, 2020. 12(4), pp. 3454-3463.
18. Achmad H, Djais AI, Jannah M, Huldani, Putra AP. Antibacterial chitosan of milkfish scales (*Chanos chanos*) on bacteria *porphyromonas gingivalis* and *agregatibacter actinomycetescommitans*. *Systematic Reviewa In Pharmacy*, 2020. 11(6), pp. 836-841.
19. Achmad H, Djais AI, Syahrir S, Fitri A, Ramadhany YF. A literature us regarding the use of herbal medicines in pediatric dentistry. *International Journal of Pharmaceutical Research*. 2020. 12, PP. 881-897.
20. Achmad H, Djais AI, Syahrir S, Fitria A, Ramadhany YF. Impact Covid-19 in pediatric dentistry: A literature review. *International Journal of Pharmaceutical Research*, 2020. 12, p.830-840.
21. Djais AI, Achmad H, Dewiayu D, Sukmana BI, Huldani. Effect of Combination of Demineralization Freeze Dentin Matrix (DFDDM/0 and *Moringa oleifera* lam osteoprotegerin (OPG) and receptor activator of nuclear factor kappa B ligand (RANKL) as a marker of bone remodeling. *Systematic Reviews in Pharmacy*. 2020. 11(6), pp.771-779.