

**DENTINO**  
**JURNAL KEDOKTERAN GIGI**  
 Vol II. No 1. Maret 2017

**COLOR CHANGES COMPARISON OF HEAT CURED TYPE ACRYLIC RESIN IN  
 IMMERSION OF ALKALINE PEROXIDES SOLUTION AND CELERY EXTRACT  
 (APIUM GRAVEOLENS L.) 75%**

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**ABSTRACT**

**Background:** Heat cured-type acrylic resin is the most widely used as denture base. denture base that is less clean may result in the accumulation of microorganisms. The chemical denture cleanser solution such as alkaline peroxide and 75% celery extract are able to clean and inhibits the growth of fungi and bacteria. The disadvantage of acrylic resin is water absorbing includes denture cleanser solution that may result in color change of resin. **Purpose:** The study is aim at measuring the color change differences of heat cured-type acrylic resin in immersion of alkaline peroxide solution and 75% celery extract (*Apium graveolens L.*) as denture cleanser for 5 days and 15 days. **Method:** The study was a true experimental research with control group design pre-test and post-test, using sample of 2mm thickness and 15mm diameters based on ADA specification no 17. Total samples were 36, divided into 6 treatment groups that is immersed in alkaline peroxide solution, 75% celery extract and aquadest for 5 and 15 days. The color change was measured using tools spectrometer, 101 photo detector and microvolt digital. The statistical test was using One-way ANOVA and Post Hoc Bonferroni with  $<0.05$  significance. **Result:** There is significance differences of color change acrylic resin in immersion of alkaline peroxide solution and 75% celery extract for 5 days and 15 days. Mean value of color change alkaline peroxide solution (0,48mv), aquadest (0,33mv) and celery extract 75% (1,36mv) for 5 days, alkaline peroxide solution (0,50mv), aquadest (0,39mv) and 75% celery extract (1,00mv) for 15 days. **Conclusion:** The immersion in 75% celery extract (*Apium graveolens L.*) 5 days and 15 days had greater value in color change than alkaline peroxide solution.

**Keywords:** Heat cured type Acrylic resin, Alkaline peroxide, 75% celery extract (*Apium graveolens L.*), Color Change.

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**INTRODUCTION**

The need of dental care in our country has increase, one kind of dental care wich is increasng in the use of denture. According to Riskesdas data (2007) of South Kalimantan Province, generally 3.3% of the population in south Kalimantan wear full denture.<sup>1</sup> Full denture are usually fabricated from heat cured type Acrylic resin because of it advantages such as non toxic, non irritating, good aesthetic, easy to manipulating and minimal dimension change. The disadvantages are fracture when it falls on a hard surface and color changes after clinical used in cavity oral for a long time.<sup>2,3</sup>

There are chemical based and natural based cleanser solution can be used as denture cleanser of acrylic resin.<sup>8</sup> Materials which can be used as a natural denture cleanser is celery. the content of celery are flavonoids, saponins and tannins which are antibacterial compounds. Tannin is the compound that may result in yellowish and brownish water. Flavonoids are also largest compound of celery and include in phenol compound which have an antibacterial, antifungal and antiviral effect. Phenol that contact with acrylic resin may result in characteristics changes of acrylic resin surface.<sup>2,9,10,11</sup>

Anindita et al (2013) suggested that extracts of celery (*Apium graveolens L.*) with a concentration

of 75% is the most effective concentration to inhibit the growth of *Candida albicans* sp, in accordance with Pelezer and Chan (1986) stated that the higher a concentration of an antimicrobial agent, the faster it can kill cells and inhibit microbial growth.<sup>12,13</sup> Denture cleanser usage instruction should be adjusted, because if the acrylic resin continuously immersed, a period of time may change their structure and color. Jordan et al (2014) stated that there were significant differences between the chemical solution chlorhexidine and alkaline peroxide, which caused by their chemical reactions and physical bond on acrylic resin material. Factors that influence the color change is intrinsic and extrinsic factors. Intrinsic factors involve a change of the material itself because imperfect polymerization, whereas extrinsic factors can be influenced by the absorption due to the absorption of the denture cleaning solution.<sup>2,7,14,15</sup> Full denture cleansing is instructed for immersion in 20 minutes every day, therefore it may penetrate the denture base and kill the microorganisms, so it is assumed that soaking every day 20 minutes for 1 year is 5 days and 3 year is 15 day.<sup>4</sup> Based on the background described above, the research is aim at comparing the denture cleanser solution alkaline peroxide with celery extract solution (*Apium graveolens* L.) 75% for color change of heat cured - type acrylic denture base.

## MATERIAL AND METHODE

The research is purely laboratory experimental research with pre and post test only also with control group design. the research is consist of three treatment such as celery extract (*Apium graveolens* L.) 75%, alkaline peroxide solution and aquadest. The research sample is heat cured type acrylic resin with cylinder shaped diameter 15 mm and thickness 2 mm based on ADA (*American Dental Association*) specification no.17. The sample is divided into 6 groups which is 6 sampel for each groups.<sup>16,17</sup>

The fabrication of acrylic resin is held in Wet laboratory of dentistry faculty of Lambung Mangkurat University. Firstly, mould of acrylic resin was made of base plate red wax total in thirty six sample. The cuvette is prepared and smeared with Vaseline, type 2 gypsum was mixed with water and was put in the cuvette above vibrator, the ratio was water : powder : 30 ml: 100 gr.<sup>17,18</sup> after

the gypsum was harden, next step is wax elimination and then smeared with cold mould seal, therefore the acrylic resin can be separated from cuvette. Acrylic resin polymer and monomer was mixed with ratio 3:1 until dough phase occurred, and then put in the cuvette. cellophane plastic was put in upper cuvette and bottom, then press it with hydraulic press with pressure 1000 psi (70kg/cm<sup>2</sup>). The cuvette was opened and the excess is eliminated and then close the cuvette again. the pressing with hydraulic press was held with pressure 2200 psi (154kg/cm<sup>2</sup>) until there were no excess and then use individual press. Next step is putting the cuvette to boiled water for 30 minutes, and let it cold in the room temperature. The sample was finished, grinded and polished with rotary bur or grinder and abrasive paper with 2000 grit.<sup>3,18</sup>

The fabrication of celery extract (*Apium graveolens* L.) 75% was held at Mathematic and nature science faculty of pharmatio program study in Lambung Mangkurat university. Celery extract was made with maseration method. Celery leaf was cleaned with water and dried in dryer rack with temperature of 45° C until dry, then blend it with a blender to form celery powder. celery powder was immersed in ethanol solution 70% and stirred 30 minutes then store it for 24 hours. after 24 hours of the immersion it will become celery filtrate and will be evaporated with vacuum *rotary evaporator* at temperature 70°C.<sup>9</sup>

As thirty six acrylic resin samples were made then it's divided into six groups so there are 6 samples for each groups immersed in a solution of aquadest, alkaline peroxide and 75% celery extract for 5 days, for 15 days. full denture cleansing is instructed for soaking in 20 minutes everyday therefore it can penetrate the denture base and kill the microorganisms, so it is assumed that soaking every day 20 minutes for 1 year is 5 days and 3 year is 15 day.<sup>4</sup>

The samples were removed and cleaned with water. Measurement of color changes value of the sample was held in the Laboratory for Optical Physics Airlangga University Surabaya. Measurements was carried out on the samples before and after immersed in denture cleaning solution by using a series of optical spectrometer tool, photo-type optical detector 101 and digital microvolt. The data was analyzed with Shapiro-wilk normality test and levene's test . If the data

were normally distributed and homogeneous then the data were analyzed using One-Way ANOVA with 95% confidence level ( $\alpha = 0.05$ ) then followed by Post Hoc Test.<sup>16,19</sup>

## RESULT

The study compare the color change of heat cured type acrylic resin that was immersed in alkaline peroxide solution, extract of celery (*Apium graveolens* L.) 75% and aquadest for 5 days and 15 days. Results obtained from normality tests are presented in Table 1 and figure 1

Table 1. Mean value and standard deviation of the measurement difference before and After Treatment

Treatment group	mean $\pm$ Standard Deviation (mv)	significance
Alkaline peroxide 5 day	0,48 $\pm$ 0,42(mv)	p= 0,43
Aquades 5 day	0,33 $\pm$ 0,09(mv)	p= 0,32
Celery extract 5 day	1,36 $\pm$ 0,15(mv)	p= 0,63
Alkaline peroxide 15 day	0,50 $\pm$ 0,07(mv)	p= 0,60
Aquades 15 day	0,39 $\pm$ 0,04(mv)	p= 0,28
Celery extract 15 hari	1,00 $\pm$ 0,16(mv)	p= 0,27

\*Saphiro wilk normality test  
p>0.05, There was a significant difference

Based on table 1 all groups are normally distributed, then to determine homogeneity of variance or group so it is followed by homogeneity test, the result show the value of p= 0.072 (p> 0.05), which means data is homogeneous. the data were analyzed with one Way Anova test with a confidence level of 95% and shows p value = 0.000 (p <0.05). Data analysis then continued with bonferroni Pos hoc test to determine which groups

had significant difference. The result are presented in table 2.

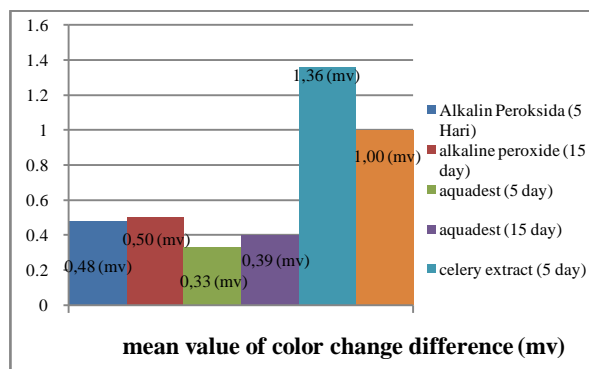


Figure 1. the diagram of Mean Value Difference of Colour Change Heat Cured Type Acrylic Resin.

Levene's test or Homogeneity test is used to know which group has significance difference and then continued with Post Hoc Bonferoni test that is presented in table 2

Table 2. significance Values of color changes comparison of heat cured type acrylic resin at immersion of alkaline peroxide solution, Extract celeryy (*Apium graveolens* L) 75%, and aquadest for 5 day .

Groups	Aquadest 5 day	Alkaline Peroxyde 5 day	celery extract 75% 5 day
Aquadest 5 day	—	0,275	0,000*
Alkaline Peroxyde 5 day	—	—	0,000*

Post Hoc Bonferoni test  
\* = There was a significant difference

Table 3. significance Values of color changes comparison of heat cured type acrylic resin at immersion of alkaline peroxide solution, Extract celeryy (*Apium graveolens* L) 75%, and aquadest for 15 day

Groups	Aquades t 15 day	Alkaline Peroxyde 15 day	celery extract 75% 15 day
Aquadest 15	—	0.275	0,000*

day			
Alkaline Peroxyde	—	—	0,000*
15 day			

Post Hoc Bonferoni test

\* = There was a significant difference

Table 4. significance values of color changes comparison of heat cured type acrylic resin at immersion of alkaline peroxyde solution, Extract celery (Apium graveolens L) 75%, and aquadest for 15 day

Groups	Alkaline Peroxyde 5 day	celery extract 75% 5 day
Alkaline Peroxyde 15 day	1.000	—
celery extract 75% 15 day	—	0.000*

Post Hoc Bonferoni test

\* = There was a significant difference

## DISCUSSION

Based on Table 2, 3 and 4 there were no significant difference between alkaline peroxyde solution with aquadest for 5 days and 15 days immersion, this is due to the content of aquadest is pure water that contains molecules of H<sub>2</sub>O only without additional element such as ions. the compound in aquadest (aquadest) is colorless, odorless and has no taste and as a weak electrolyte. while the alkaline peroxyde solution is a denture cleansing agents containing alkaline compound, sodium perborate, when the material is mixed with warm water then sodium perborate will decompose and release nascent oxygen that act as a cleanser to denture base.<sup>3,20</sup>

Color changes are caused by several factors such as the size of the sample, microporous on the sample and duration of contact between the denture base to the cleanser solution. Alkaline peroxyde and aquadest in the immersion 5 days compared with 15 days did not show any significant difference, this is due to time is not long enough for acrylic resin contact to alkaline peroxyde and aquadest.<sup>3</sup>

There were significant difference between immersion of alkaline peroxyde and celery extract 75% for 5 days and alkaline peroxyde and celery

extract 75% for 15 days, this is due to the active ingredient in alkaline peroxyde ingredients that influence the properties of acrylic resin. Chemical cleanser is often used as a denture cleanser due to antibactericidal and antifungi properties.<sup>22</sup> alkaline peroxyde cleanser effectively removes stains on the denture base, but it has the disadvantage such as discoloration of denture base. Jordan et al (2014) stated that the change of color in acrylic resin is immersed in alkaline peroxyde caused by the content of sodium perborate. When dissolved in water, the sodium perborate decomposes and produces H<sub>2</sub>O<sub>2</sub> hydrogen peroxide + alkaline, 2 H<sub>2</sub>O<sub>2</sub> ⇌ 2H<sub>2</sub>O + 2O (nascent oxygen).<sup>3</sup> Nascent oxygen have the effect of chemical cleanser to material, but there is adverse effects associated with strong oxidizing of the solution so released oxygen may result in oxidation tertiary amine accelerator or unreacted double bonds in the resin matrix acrylic. Chandu et al (2015) stated that when the acrylic denture base were repeatedly immersed in a solution of alkaline peroxyde for 30 days so it can bleach denture base surface.<sup>2,3,22</sup>

Components of the active substance in celery extract 75% is phenols and tannins. Flavonoids are the largest of phenol compounds in green plants, it can inhibit the growth of microorganisms. Phenol when in contact with acrylic resin may cause changes in the surface characteristics of the resin, while the tannins are subtle content to the water may change the color of water in to yellowish or brownish.<sup>2,3,24</sup>

Sukma et al (2012) stated in the research that the tannins are also can affect the color change of acrylic resin. Tannins have acidic properties that cause the hydrolysis reaction between phenols and esters of polymethyl-methacrylate in the acrylic resin, so that the bond of polymer chain becomes disrupted and increases the incidence of porosity. Tannins itself has a polar structure which may result in stronger chemical bonding and oxygenated easily in oxygen in the air and water environment therefore discoloration can be occurred. There were significant difference between celery extract group and alkaline peroxyde, this is due to long contact time between the cleanser solution with sample.<sup>21-23</sup>

According to Chandu et al (2015) research, water absorption to acrylic resin may affect the characteristics and the dimensions of the polymer acrylic resin that causes macromolecules more easily move, so it may weaken the bonds of

polymer chains. The absorption of water in acrylic resin may result in expansion of polymerized mass and lowering the strength of polymer bond.<sup>2,21</sup>

Factors that influence the color change of acrylic resin is intrinsic factor and extrinsic. Extrinsic factors are influenced by the absorption due to the absorption of denture cleaning solution. This is due to the accumulation of pigments on the surface adsorption and the absorption penetrate to pores of the acrylic resin, so that the color is absorbed more than the reflected color of a material.<sup>2,6,15</sup>

It can be concluded that there are differences in color change among the heat cured type of acrylic resins in immersion of alkaline peroxide solution with celery extract (*Apium graveolens L.*) 75% for 5 days and 15 days, and there is a difference in the color change of the aquadest solution with celery extract (*Apium graveolens L.*) 75% in 5 days and 15 days. Extracts of celery (*Apium graveolens L.*) 75% group experienced a change in value of a darker color than the alkaline peroxide and aquadest. Different with comparison of alkaline peroxide solution with sterile aquadest for 5 days and 15 days which there is no different discoloration.

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