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Biological Effect of *Peronema canescens Jack* on The Surface Changes of Alginate Mold

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ABSTRACT

Background. The patient's oral cavity is one of the transmission agents that has the potential for cross-infection. Saliva adhering to the surface of the alginate mold, apart from containing a lot of microorganisms, also disrupts changes in the alginate surface due to changes in salivary pH. Sungkai leaves (*Peronema canescens Jack*) contain active compound that can maintain the alginate constituent elements' integrity and alginate's surface properties. **Objective**. This study aimed to determine the biological properties of *Peronema canescens Jack* on changes in the alginate impression surface by immersion and spraying methods. **Materials and Methods**. The research material comprised 72 alginate impressions totaling six groups (12 samples/group). The sample categories used matrices and stainless steel rings and were measured within 5, 10, and 15 minutes. Changes in the alginate impression surface were observed using a stereo microscope. **Results**. Soaking and spraying with Sungkai leaf extract within 5 and 10 minutes did not affect the surface of the mold, while spraying within 15 minutes was within standard clinical limits. **Conclusion**. Sungkai leaf extract can maintain the integrity of alginate impressions by immersion and spraying techniques.
Keywords: Alginate mold, *Peronema canescens Jack*, Surface Change

ABSTRAK

Latar belakang: Rongga mulut pasien merupakan salah satu agen penularan yang berpotensi terjadinya infeksi silang. Saliva yang menempel pada permukaan cetakan alginate selain banyak mengandung mikroorganisme juga menganggu perubahan permukaan alginate akibat pengaruh sifat perubahan pH saliva Daun sungkai (*Peronema canescens Jack*) mengandung senyawa aktif yang berpotensi mempertahankan integritas unsur penyusun alginate, sehingga dapat mempertahankan sifat permukaan alginate. **Tujuan**. Tujuan dari penelitian ini adalah untuk mengetahui sifat biologi *Peronema canescens Jack* terhadap perubahan permukaan cetakan alginate dengan metode perendaman dan penyemprotan. **Bahan dan Metode**: Materi penelitian terdiri dari 72 cetakan alginat berjumlah dalam 6 kelompok (12 sampel/kelompok). Kategori sampel menggunakan matriks dan cincin stainless steel dan diukur dalam waktu 5, 10, 15 menit, perubahan permukaan cetakan alginat diamati menggunakan mikroskop stereo. **Hasil**: Perendaman dan penyemprotan dengan ekstrak daun sungkai dalam waktu 5 dan 10 menit tidak berpengaruh pada permukaan kapang, sedangkan penyemprotan dalam waktu 15 menit masih dalam batas standar klinis. **Kesimpulan**: Ekstrak daun sungkai dapat digunakan sebagai larutan untuk mempertahankan integritas cetakan alginate baik dengan teknik perendaman maupun penyemprotan.
Kata Kunci: Cetakan Alginat, Daun Sungkai (*Peronema canescens Jack*), Perubahan Permukaan

1. Introduction

According to Basic Health Research (Riskesdas) data, in 2018, tooth loss in Indonesia occurred at the age of 65 years and over by 9%. Loss of teeth can be treated by making artificial teeth. At the initial stage of making dentures in prosthodontics, a jaw impression stage is required using impression materials (Kemenkes RI, 2018). An impression is a work procedure that is often done in the field of dentistry.[1]

The use of alginate impression material is still an option for dentists because it has several advantages, including (1) it can be manipulated easily, (2) it does not require many tools, (3) it is relatively inexpensive, and (4) it is comfortable for patients.[2] Alginate impression material is easily tolerated by patients because there is a refreshing aroma, such as chewing gum taste, to reduce the

gag reflex. The disadvantages of alginate impression materials are that they have imbibition properties to absorb water when in contact with water so that they expand or expand and have synergetic properties, namely shrinkage when left too long in the open air. It can cause deformation of the mold, thereby reducing the accuracy of the mold.[3]

Contamination from bacteria can be avoided by disinfecting the printed material used. Disinfectants used in dentistry are divided into chemical disinfectants and natural materials. One of the chemicals used as a disinfectant is sodium hypochlorite, according to Amelia's research (2023).[4] Sodium hypochlorite with a concentration of 0.5% has been proven effective in preventing cross-infection because it is efficient against broad-spectrum microorganisms and can fight bacteria, fungi, and viruses. According to the Environmental Protection Agency (EPA), sodium hypochlorite does not damage the material's surface. Print is not irritating but has the disadvantage of an unpleasant odor and irritation to the skin and eyes. Therefore, it is necessary to research alternative natural materials with non-toxic disinfectant properties to prevent cross-infection.[5] According to the ADA, disinfection can be carried out by immersion and spraying. So far, no research has been conducted on the effect of spraying and immersion techniques of sungkai leaf extract as a disinfection agent on changes in the surface of alginate molds.[6] It is what underlies the researchers to examine the effect of immersion disinfection techniques and spraying 1% sungkai leaf extract on changes in alginate mold surface.

Based on the background that has been explained, the formulation of the problem can be drawn: Is there an effect of immersion disinfection time with 1% sungkai leaf extract on changes in the surface of the alginate mold within 5, 10, and 15 minutes? Is there an effect of spraying disinfection time with 1 Sungkai leaf extract 1% of the change in the surface of the alginate impression within 5, 10, or 15 minutes? The study aimed to determine the biological properties of *Peronema canescens Jack* on changes in the alginate impression surface by immersion and spraying methods.

2. Material and Methods

This research was conducted in the Biology laboratory, Department of Biology, FMIPA, Padang State University, in January 2022. The test material used was sungkai leaves (*Peronema canescens Jack*) obtained from medicinal plants in Padang City, Sumatra Barat, Indonesia.

2.1. Extract Preparation

The Sungkai leaves, which weighed 3 kg, underwent a process of purification through running water to eliminate any extraneous substances present on the leaves. Subsequently, the leaves that had undergone the cleaning process were subjected to a drying procedure, where by they were aired and shielded from direct exposure to sunlight for approximately three days. After drying, the sungkai leaves were meticulously sorted to remove residual twigs and leaves, then finely chopped into small fragments. Subsequently, the maceration process was executed by immersing the incised sungkai leaves into a solution of 80% ethanol with a volume of 5 liters. The concoction was subjected to a 24-hour maceration period, during which agitation was performed at 4-hour intervals. Following the maceration period, the concoction underwent decantation and filtration procedures, while the remaining substance was subjected to a similar maceration process utilizing newly acquired 80% ethanol for 48 hours.

The filtrate was gathered and subjected to solvent evaporation via a rotary vacuum evaporator, forming a solid extract. Following this, the solid section was subjected to a heating process at a temperature of 45°C to eliminate any residual 80% ethanol. Subsequently, the specimen was preserved in an opaque container and securely sealed to uphold its integrity. In order to create a diluted solution of the concentrated extract from sungkai leaves, a ratio of 1 mg of extract to 10 mg of Phosphate Buffered Saline (PBS) solution was utilized. Subsequently, the amalgamation underwent vibration with a volume of 25 ml, resulting in a concluding concentration of 1%.[7]

2.2. Alginate Mold Preparation

Alginate samples were prepared by preparing a stainless steel ring matrix. Alginate powder and water were measured with a spoon and measuring cup in a 16.8 g to 40 ml ratio. The powder was then added to the water in a rubber bowl, and a figure eight movement was performed quickly using a spatula to mix the ingredients until homogeneous for 45 seconds. The resulting

alginate mixture was placed on the surface of the matrix after positioning the ring. A plastic plate was placed on the ring matrix to apply pressure to the alginate impression material, simulating finger pressure. The mixture was left to set for approximately 2 minutes. The alginate prints were then washed with running water for 15 seconds. The surface of the alginate impression was measured using a stereo microscope and assessed based on a rating scale of 1 to 4. After washing, the alginate prints were immersed in a 1% sungkai leaf extract solution, ensuring that the entire surface of the alginate mold was submerged. The molds were stored in the solution for 5, 10, or 15 minutes. Subsequently, the molds were rinsed again and gently tapped to remove excess water. The surface of the alginate impression was measured using a stereo microscope and evaluated using a rating scale of 1 to 4.[8]

The alginate prints were washed with running water for 15 seconds again. The surface of the alginate impression was measured using a stereo microscope and assessed based on a rating scale of 1 to 4. Finally, the alginate prints were washed with running water for 15 seconds. A 2 mL spray of 1% sungkai leaf extract solution was applied to the entire surface of the alginate mold from a distance of approximately 5 cm. The mold was then wrapped with a tissue moistened with a disinfectant solution and stored in a closed container for 5, 10, or 15 min. After rinsing the alginate mold once more and tapping gently to remove excess water, the surface of the alginate impression was measured using a stereo microscope and evaluated using a rating scale of 1 to 4.

2.3. *The scoring assessment of the alginate Mold Surface*

Observations were made on changes in the sharp of the alginate mold using a stereo microscope. For line reproduction of the alginate printed surface to pass the ADA specification, the detailed replica of the surface must visually produce the entire length of the line as wide as 50 m. Rating 1: Well-defined, sharp details, continuous lines. Rank 2: Continuous line but with a loss of harpness. Rating 3: Loss of line continuity or significant loss of detail. Rank 4: Little or no visible line production.[9]

Figure 1. The alginate mold's surface was observed to determine its adherence to the ADA specification 50 m line (Doc)

2.4. *Data analysis*

The descriptive analysis describes the tabulation of research data by ranking the surface of the alginate mold from each research result.

3. Result and Discussion

Table 1 shows that the mean of the immersion technique before treatment was ranked one while after treatment with 1% sungkai leaf extract, and the control group was mainly at the 15-minute immersion time, which was rated 3.

Table 1. Surface change of alginate mold treated by Immersion approach of sungkai leaf extract

Sample	Surface change of alginate mold									
	Before	Treatment Gorup (min)			Positive control (min)			Negative group (min)		
		5	10	15	5	10	15	5	10	15
1	1	1	2	3	2	2	3	1	2	3
2	1	1	2	3	2	2	3	1	2	3
3	1	1	2	3	2	2	3	1	2	3
4	1	1	2	3	2	2	3	1	2	3
X±SD (mm)	1±0,000	1±0,000	2±0,000	3±0,000	2±0,000	2±0,000	3±0,000	1±0,000	2±0,000	3±0,000

Table 2 shows that the average spraying technique before treatment was ranked one. In contrast, after treatment with 1% sungkai leaf extract and the control group, there was the most tremendous change in the surface of the alginate mold at the time of spraying 15 minutes, namely at rank 2. It can be seen that in Figure 4.1 before treatment and after treatment, the 1% sungkai leaf extract and the control group at 5 minutes showed rank 1 with a blue profile, while at 10 minutes, all treatments showed rank 2 with a red profile, and 15th indicates rank 3 with a green profile.

Table 2. Surface change of alginate mold treated by Spray approach of sungkai leaf extract

Sample	Surface change of alginate mold									
	Before	Treatment Gorup (min)			Positive control (min)			Negative group (min)		
		5	10	15	5	10	15	5	10	15
1	1	1	1	2	1	1	2	1	1	2
2	1	1	1	2	1	1	2	1	1	2
3	1	1	1	2	1	1	2	1	1	2
4	1	1	1	2	1	1	2	1	1	2
X±SD (mm)	1±0,000	1±0,000	1±0,000	2±0,000	1±0,000	1±0,000	2±0,000	1±0,000	1±0,000	2±0,000

The present investigation aimed to ascertain the impact of immersion and spraying with 1% sungkai leaf extract on alterations in the visual characteristics of alginate molds. In this study, the treatment involved subjecting the experimental group to immersion and spraying with a 1% solution of sungkai leaf extract for 5, 10, and 15 minutes. The surface measurements of alginate impressions were obtained through a stereo microscope. According to the findings presented in Table 1, the group that underwent treatment and those that did not were ranked first in the four samples at the 5-minute mark. This can be attributed to the alginate impression material being exposed to running water and a 1% solution of sungkai leaf extract for a relatively brief period. As a result, water absorption during the process was not prolonged, preventing the alginate mold's water content from becoming excessively high and causing distortion.[10]

Consequently, the alginate mold maintained a stable surface and did not experience any expansion. An alginate mold is formed after the mold is immersed in a disinfectant solution, followed by imbibition. Imbibition refers to the absorption process of the alginate impression material, which results in expansion. This phenomenon is attributed to the presence of osmotic potential ions, such as sodium, sulfate, and phosphate, within the alginate material. The range of clinical tolerance encompasses rank 2.[4]

The post-treatment group at the 15-minute mark exhibited a rank of 3, surpassing the clinical threshold as the mold's surface has undergone a loss of detail. The findings indicate that the extract of sungkai leaf comprises phenolic compounds. Upon interaction between phenolic compounds and alginate impression material, an esterification reaction takes place. This reaction involves the formation of esters and H2O, wherein phenolic compounds bind to a carboxylic acid present in the

chemical structure of the alginate impression material. Sungkai leaf extract contains phenolic compounds that exhibit hydrogen bonding with water molecules. The aqueous binding of phenol facilitates the absorption of the liquid present in the extract of sungkai leaves into the alginate mold. The occurrence of imbibition in the alginate impression can be attributed to the presence of H2O in the reaction and the inherent nature of the alginate, leading to alterations in the surface of the impression.[11]

The observed data indicates that the control group (+) exhibited identical rankings at 5 and 10 minutes, both at rank 2. The most significant alteration in the ranking was observed at minute 15, where the control group (+) exhibited a status of 3. This phenomenon is because the natural decomposition of sodium hypochlorite occurs upon reaction with water. Gradually discharge chlorine, oxygen, and sodium hydroxide. The subsequent oxidation phenomenon arises due to the potent oxidizing properties of oxygen, leading to perturbations in the pressure within the solution. When sodium hypochlorite comes into contact with alginate impression material, it exerts pressure, causing it to expand.[10] The alginate impression material exhibits hydrophilic properties, whereby it readily absorbs water. The adsorbed solution exerts a pressure gradient, facilitating absorption and potentially inducing surface alterations in the alginate impression.[11]

The alteration in the color of the alginate print surface after immersion in sungkai leaf extract can be attributed to the presence of anthocyanin compounds in the extract. These compounds are classified under the flavonoid compound group, the most extensive group of natural pigments in plants exhibiting water solubility.[12] The alteration in the hue of the alginate impression material is attributed to its property of water absorption or imbibition. The anthocyanin content is accountable for pigment production, resulting in the manifestation of a yellow hue.[13]

The mixing process also influences the precision and size of the alginate impression substance. The utilization of fully automated mixing techniques can result in the production of high-quality dough, which can have an impact on the time required for printing. A dough with exceptional precision can be achieved by accurately measuring the appropriate amount of powder and adding water per the prescribed dose of alginate powder. This approach effectively addresses the issue of air bubbles and enhances overall perfection. Agitation by mechanical means can result in improved viscosity compared to manual stirring.

From a clinical perspective, it has been observed that the disinfectant containing 1% sungkai leaf extract exhibits a disinfection efficacy equivalent to that 0.5% sodium hypochlorite. However, the latter displays a higher bacterial growth inhibition due to hypochlorous acid, which can react with various biological molecules such as proteins, amino acids, peptides, lipids, and DNA under physiological conditions.[14] As a result, the World Health Organization recommends the use of 0.5% sodium hypochlorite despite its drawbacks, including an unpleasant odor and a burning sensation upon skin contact.[15]

The present investigation revealed an alteration in the surface of the alginate mold after 15 minutes. The present study is consistent with prior research conducted by Trivedi et al. (2019), which reported that exposure to a 2% glutaraldehyde disinfectant solution for 15 and 20 minutes caused alterations in the dimensions of prints. Specifically, the alginate mold exhibited mean dimensions of 30.60 mm and 30.57 mm due to immersion in the solution mentioned above, which contained both water and glutaraldehyde.[16]

The findings of Prabowo et al. (2021) align with the current study, indicating a noteworthy alteration in the group that underwent a 15-minute immersion in a green tea extract leaf solution. It can be attributed to the imbibition properties of alginate, which facilitate the expansion of prints upon contact with green tea leaf extract containing phenolic compounds.13,14. Immersion disinfection techniques offer the benefit of uniform distribution of disinfectant across the complete surface of the impression material.[17] However, the downside of this method is that the impression material may undergo expansion after a particular duration, owing to the imbibition characteristics of alginate that facilitate water absorption. The objective of the current research was to examine the differentiation between the control group (Group D) and the experimental groups, specifically Group E (exposed to NaOCl treatment) and Group F (exposed to bay leaf decoction treatment). The gel-like consistency of alginate impression materials results in the manifestation of syneresis and imbibition properties.[18]

According to the findings presented in Table 2, the pre-treatment groups exhibited a rating of 1. Following treatment with a 1% solution of sungkai leaf extract, the control group demonstrated consistent ratings at 5, 10, and 15 minutes. This uniformity can be attributed to the alginate

impression material exposed to the sungkai leaf extract solution. Briefly, the control group and the 1% sample exhibited a dissimilar water absorption process. This led to a lower water content within the alginate mold, preventing expansion and distortion. Consequently, the alginate mold retained its stable surface. (kintantiningtyastuti) The extract contains phenolic compounds. The leaves of Sungkai possess hydrogen molecules that can establish chemical bonds with water molecules. The aqueous binding of phenol facilitates the absorption of the liquid content of sungkai leaf extract into the alginate mold.[19] The introduction of H_2O during the reaction process leads to alterations in the surface of the alginate mold due to its synergetic properties. The spraying technique is deemed more advantageous as it minimizes the exposure of the alginate mold to the disinfectant solution, resulting in a superior rating of 2.[20]

When sodium hypochlorite comes into contact with alginate impression material during the disinfection process, it can cause stress. Alginate impression material can absorb water, resulting in the absorption of pressure from the absorbed solution, leading to the imbibition of the alginate impression. However, using the spraying technique results in reduced liquid absorption. The imbibition is reduced, resulting in a maximum alteration of the alginate impression surface of only 2.[21]

As per the guidelines provided by the American Dental Association (ADA), submerging the alginate impression material in a disinfectant solution for 10 minutes is advisable. Impression material may be subject to inaccuracies if the duration of the process exceeds 10 minutes due to the potential influence of the imbibition process.[22] The second rank is within the clinical tolerance threshold as it retains its distinguishability as a continuous line. The statement is supported by evidence. The research conducted by Bailey and colleagues (2022) suggests that no statistically significant distinction between alginate molds that were subjected to a 50% red betel leaf infusion with spraying technique and those that were treated with a 0.5% sodium hypochlorite solution for durations of 5 and 10 minutes.[23] The results are in line with the research carried out by Valdina et al. (2014), indicating that the utilization of the alginate mold spraying method with a 0.5% concentration of sodium hypochlorite for 10 minutes leads to a minor modification in the dimensional stability of alginate.[24]

The present study's findings suggest that using natural constituents, specifically a 1% extract of sungkai leaf, may substitute chemical disinfectant solutions, as the mean distance is nearly equivalent, particularly in the spraying technique lasting 5 to 10 minutes. The utilization of a 1% extract of sungkai leaf presents a viable substitute for conventional disinfectants. The sungkai leaf possesses potent disinfectant properties without adverse effects typically associated with synthetic chemicals.[25]

4. Conclusion

Based on the research that has been done on the effect of soaking time and spraying 1% sungkai leaf extract as a solution on changes in the surface of the alginate mold, it can be concluded as follows. There is an effect of immersion with 1% sungkai leaf extract on changes in the surface of the alginate mold at 15 minutes. There was an effect of spraying with 1% sungkai leaf extract on changes in the surface of the alginate mold at 15 minutes, but at level 2, it was still within the limits of clinical standards.

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Authors Contribution

Contribution	Fadriyanti O	Afriza D	Chaerunnisa C
Concepts or ideas	V	V	V
Design		V	
Definition of intellectual content	V		
Literature search		V	
Experimental studies	V		
Data acquisition			V
Data analysis	V		
Statistical analysis			V
Manuscript preparation	V	V	V
Manuscript editing	V	V	V
Manuscript review	V	V	V

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