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PROPOLIS EXTRACT SORPTION AS A PULPCAPPING AGENT

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ABSTRACT

***Background**: This research is an experimental study to determine the physical properties of propolis extract as an alternative material in pulpcapping treatment. High sorption value is the main cause of pulpcapping treatment failure. **Purpose**: to analyze the sorption value of propolis extract in water and artificial saliva. **Materials and Methods:** Thirty disc-shaped zinc oxide propolis (15 mm x 1 mm) specimens were stored in the incubator at 37ºC for 24 hours. The discs were weighed, dehydrated, and weighed again. Immediately after weighing, the discs were immersed for 1 day, 3 days, and 7 days in 50 mL of distilled water and artificial saliva at 37ºC and then weighed for second time (sorption value). Data were analyzed by one way ANOVA for data processing in the water and artificial saliva immersion group, then the Independent T-Test for inter-group immersion in water with artificial saliva. **Results:** There were differences in the sorption value of zinc oxide propolis with ZnOE (positive control) in water and artificial saliva between immersion times of 1 day, 3 days, and 7 days. There was no difference in the sorption value of zinc oxide propolis between the water and the artificial saliva immersion group. **Conclusion:** The sorption value of propolis extract, both in water and artificial saliva immersion shows a high sorption value. This indicates that the propolis extract has not met the criteria as a pulpcapping material in terms of its physical properties, namely absorption of water (water sorption).*

***Keywords:** Propolis extract, Pulpcapping, Sorption*
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INTRODUCTION

The research using natural ingredients has been conducted and reported. All of them are aimed at producing medicines to support dental health service programs particularly to prevent and treat dental caries. Attention back to natural ingredients is considered very beneficial due to our society has been believed since ancient times that natural ingredients can treat various diseases. Besides, the use of natural ingredients as medicine rarely causes adverse side effects compared to drugs which are made from synthetic materials.[1,2]

Propolis is one of the biological ingredients of traditional medicine that has been known since ancient times and it was used as an antiseptic to heal wounds and as a mouthwash in medieval times among Arabian doctors.[3,4]

The pharmacological active molecules in propolis are organic volatile components, flavonoids, phenolic acids and other ester groups, phenol aldehydes, alcohols, ketones, quinones, coumarins, steroids and amino acids. These components can provide pharmacological activity.[3,5]

The effects of anesthetics, antibiotics, and its ability to regenerate bone make propolis widely recommended for dental cavities treatment. Toothpaste containing propolis and zinc oxide can improve dentin repair and promote enamel remineralization.[6] Research on the anti-inflammatory effects of propolis in dentistry has been carried out by Sabir (2005), this study aims to produce a medicament for dental pulp which acts as a protection agent for dental pulp or as a liner in pulpcapping treatment.[7]

Pulpcapping is a dental treatment which is performed in an attempt to protect the injured pulp from inflammation and further damage. Inflammatory conditions of the pulp that can be treated by

pulpcapping are pulpal diagnosis in the form of reversible pulpitis.[8] Pulpcapping treatment is divided into indirect pulpcapping and direct pulpcapping. Indirect pulpcapping is a treatment to maintain the pulp to keep it vital by placing the pulp protection agent on the base of the cavity where the pulp chamber is still covered with a layer of dentin. Meanwhile, direct pulpcapping has the same principle but the pulp condition is already exposed and the placement of the pulp protection agent is applied to the exposed pulp area.[9,10,11] Currently, material used as pulp material protection agents are ZnOE, calcium hydroxide and MTA. Pulpcapping agent should have a function as protection from chemical reaction, electrical, mechanic and temperature. The specifications that should be possessed by a pulp protection agent are biocompatibility, composition, attachment to the teeth, physical properties, mechanical properties and chemical properties. One of the physical properties of the pulp protection agent is water sorption and solubility. This physical property is closely related to one of the specifications for the pulpcapping agent, which should have the ability to produce a thin layer that can provide the pulp's first protection against the residual of restorative material, oral fluids, or both, particularly oral fluids which its presence is very difficult to be avoided.[12] The consideration that must be an important concern for practitioners is the solubility of the pulpcapping agent under the restorative material cause leakage which can lead to sensitivity and continues pulp damage.[13]

The water sorption of dental cement material are important properties to be assessed. A dental cement material should be tested for water sorption. Water sorption can have detrimental and beneficial effects. The detrimental effect of water sorption can affect dimensional changes, reduce retention and the formation of cracks of the dental cement material.[14] Research of the sorption of propolis extract as a pulp protection agent has never been carried out. Propolis extract is a material with semi-solid properties, to be able to meet the sorption test specifications requires a binder mixture to become a solid form. The powder used is zinc oxide, which has good biocompatibility to dental pulp. This study aims to determine the sorption of propolis extract in water and artificial saliva.

RESEARCH METHODS

Research methods for water sorption and solubility of material are arranged based on the *International Standard Organization 4049 (2000)* and the *American Dental Association (ADA) Specification No.8*. Specimen specifications included specimen size (15 mm diameter x 1 mm thick) and immersion time between 1 day to 7 days. Thirty samples of disc-shaped zinc oxide propolis (15 mm x 1 mm) were stored in the incubator at 37ºC for 24 hours. The discs were weighed, dehydrated and weighed again. Immediately after weighing, the discs were immersed for 1 day, 3 days and 7 days in 50 mL distilled water and artificial saliva at 37ºC and then weighed for second time. Data were analyzed by one way ANOVA for data processing in the water immersion group and the artificial saliva immersion group, then the Independent T-Test to analyze inter-group immersion in water with artificial saliva. One way ANOVA was used to determine the differences in sorption of ZnO+Propolis in each liquid and the length of immersion, while the T-Test statistical test was to determine the difference in sorption between immersion in water and artificial saliva.

RESULT AND DISCUSSION

One way ANOVA test for the sorption value of zinc oxide propolis in water and artificial saliva immersion showed p-value<0,05, which means that there was a significant difference between immersion times of each group.

Table 1. Table mean and standar deviation of of the sorption of propolis extract in water between the immersion time of 1 day, 3 days and 7 days.

	Sorp. Day 1th	Sorp. Day 3rd	Sorp. Day 7th
Mean±SD	505.65±28.07	1267.45±42,21	2889.30±11,60

Table 2. Cross-tabulation of the significant value of the sorption of propolis extract in water between the immersion time of 1 day, 3 days and 7 days.

		ZnO+Propolis		
		1 day	3 days	7 days
ZnOE	1 day	-	0,000	0,000
	3 days	-	-	0,000
	7 days	-	-	-

Table 3. Cross-tabulation of the significant value of propolis extract sorption in artificial saliva between immersion times of 1 day, 3 days and 7 days.

		ZnO+Propolis		
		1 day	3 days	7 days
ZnOE	1 day	-	0,000	0,000
	3 days	-	-	0,000
	7 days	-	-	-

In the Independent T-Test results for the sorption value of zinc oxide propolis in water and artificial saliva for each immersion time, the value of p> 0.05 was obtained which means that there was no significant difference in the of zinc oxide propolis

between immersion in water and artificial saliva at each immersion time.

Table 4. Cross-tabulation of the significant value of zinc oxide propolis sorption in water and artificial saliva between each immersion time.

		Artificial Saliva		
		1 day	3 days	7 days
Water	1 day	0,719	-	-
	3 days	-	0,498	-
	7 days	-	-	0,897

In the current study, the sorption value of materials in water and artificial saliva significantly increased on days 1, 3 to 7. The material sorption value in water immersion showed no statistically significant difference with the material sorption value in artificial saliva immersion, this is due to the composition of artificial saliva itself is 99% H_2O. However, when compared with the control group (ZnOE), there were differences in the material sorption value in water and artificial saliva immersion. The sorption value of zinc oxide propolis in water immersion for 1 day was 2796,4 $\mu g/mm^3$, which showed a high sorption value when compared with the sorption value of zinc oxide eugenol (control) in water immersion for 1 day with a sorption value of 505,6 $\mu g/mm^3$. The comparison of the sorption values of the materials is highly different. Likewise, the sorption values difference occurred in the immersion group for 3 days and 7 days, in water and artificial saliva. This may be due to the condition of the zinc oxide propolis specimen which does not undergo a setting reaction. The propolis extract, which is a semi-solid material (gel) in the mixing process with zinc oxide powder does not undergo a chemical reaction or only a few chemical reactions occur. In the present study, with the basic ingredient of pure propolis extract, the specimens were not heated to more than 37ºC due to the nature of propolis itself which melts at temperatures above 40ºC.[4]

The sorption value of propolis extract, both immersion in water and artificial saliva shows a high value, it shows that the propolis extract has not met the criteria as a pulpcapping material in terms of its physical properties, namely water sorption. The sorption value of the pulp protection agents currently used is between 2,15% and 8,57% of the material initial weight.[12] Whereas in the current study with 7 days in both water and artificial saliva immersion, zinc oxide propolis has a sorption value of 40,4% of the initial weight. The value of sorption and solubility of materials in water and artificial saliva is determined by several factors, including the composition of the material, the polarity of the molecular structure, the presence of a hydroxyl group that can form hydrogen bonds with water, the water diffusion coefficient and the concentration inside and outside the specimens.[13] The composition of the zinc oxide propolis specimen is obtained after carrying out the preliminary research procedure with a ratio of 1 part zinc oxide and 1 part propolis gel, this ratio is adapted from a comparison of pulp protection materials which are already on the market based on the manufacturer's instructions regarding material manipulation with a ratio of 1:1. However, the results of the current study show that the water sorption and solubility of the material are quite high compared to the pulp protection agents used in dentistry today.

Based on this study, it can be concluded that there are differences in the sorption value of zinc oxide propolis in water and artificial saliva between immersion times of 1 day, 3 days and 7 days. There was no difference in the sorption value of zinc oxide propolis between immersion in water and artificial saliva.

It is necessary to do further research on the sorption of propolis in water and artificial saliva by changing the ratio of propolis composition to zinc oxide or by adding other materials that can provide a setting reaction in propolis to produce a low sorption value without neglecting the biocompatibility of pulp tissue.

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