EFFECT OF Musa acuminate AND Ocimum basilicum MIXED EXTRACTS ON BIOACTIVE RESIN'S FLUORIDE

by Dewi Puspitasari

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EFFECT OF *Musa acuminate* AND *Ocimum basilicum* MIXED EXTRACTS ON BIOACTIVE RESIN'S FLUORIDE RELEASE

INTRODUCTION

Mouthwash is one of the dental and oral health care products used to reduce infections, plaque, and halitosis.[1]The standard gold mouthwash for the oral cavity that is often used is Chlorhexidine Gluconate (CHX). Long-term use of CHX may have a negative effect on the oral cavity.[1, 2] The number of side effects due to chemical mouthwash leads herbal plants as an alternative to natural mouthwash, one of the herbs that may be used is Mauli Banana.[3] Mauli Banana (*Musa acuminata*) is one of the typical plants of South Kalimantan. Apriasari et al (2014) research proves that the compounds contained in mauli banana stem extract have function as antioxidants, antibacterial, antifungal, and do not cause cell toxicity.[4] Other plants that also have antibacterial ability are the basil leaves (*Ocimum basilicum* L.)[5] The leaves of basil (*Ocimum basilicum* L.) contain essential oils with the highest content named linalool, which is similar to terpenoid alcohol.[5, 6] The extract of basil leaves used as herbal mouth rinses may increase the rate of salivary flow which has an effect on increasing the pH of the oral cavity.[7]

Tests of fetotoxicity have also proven that administration of basil leaves methanol extract at doses of 50 and 100 mg / kg body weight does not show fetotoxicity effects on white mice.[8] The use of mouthwash as an antiseptic of the oral

cavity may expose all parts of the oral cavity and also restoration material on the teeth. Composite resin is one of the most selected restoration materials by patients and dentists[9] Bioactive composite resins are materials that able to releasing fluoride ions if intra oral pH value down below the critical pH (5.5). The process of releasing fluoride ions begins with the effect of changes in pH of the oral environment.[10] Mouthwash is one of the triggers for pH changes from the oral cavity. The lower the pH of the oral cavity, makes higher release of fluoride ions.[11] The aim of this study is to analyze the effect of Mauli Banana (*Musa acuminata*) and basil leaves (*Ocimum basilicum* L.) extracts on the release of fluoride ions in bioactive composite resin.

MATERIALS AND METHODS

The research has passed the etichal clearance test published by the Faculty of Dentistry, Lambung Mangkurat University No. 350 / KEPKG-FKGULM / EC / I / 2019. This study is a pure experimental study (true experimental) with a post-test only and control group design. specimens were fabricated with composite resin (Activa ™ Bioactive Restorative, Pulpdent), susequently immersed for 7 days at 37°C in a mixture of extracts of Mauli Banana stem extract and basil leaves concentrations of 25%, 50%, 75%, 100%. The controls used are CHX and aquades. Each group consisted of 5 bioactive composite resin specimens.

The extracts was made with maceration method. Mauli Banana stem extract and basil leaves concentrations 100% is made by immersion the simplicia of Mauli banana stems for 5x24 hours while basil leaves for 3x24 hours in 70% ethanol solvent. Maserat is filtered and evaporated with a rotary evaporator with a heating temperature of 40°C and evaporated again in the water bath until a thick 100% extract is obtained.

A mixture of Mauli banana stem extract and basil leaves extract with a concentration of 100% is a combination of mauli banana stem extract 25% and basil leaves extract 10% with a volume ratio of 1: 1.[12] Maula banana stem extract mixture and basil leaf extract with 100% content then diluted using aquades with a series of 25%, 50%, and 75% concentration.

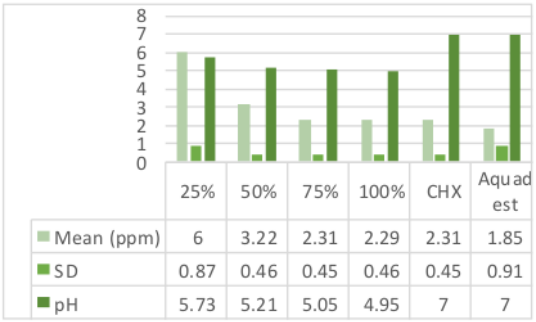
Thirty specimens were fabricated using Bioactive composite resin (Activa ™ Bioactive Restorative, Pulpdent) with size of 15 mm on diameter and 1 mm on thickness based on ISO 4049 (2000). Bioactive composite resin was polymerized for 20 seconds using LCU (Woodpecker) with a distance of 1 mm from the specimens surface. Celluloid strips are removed after the bioactive resin composite setting. Specimens were stored in saline solution and placed in an incubator at 37°C for 24 hours.

Measurement of the amount of release of fluoride ions begins with grinding the sample until fine particle and put in a beaker. The crushed sample was diluted with 10ml of distilled water and 10 ml of sodium fluoride buffer, followed by immersing the electrode in the sample solution for 3 minutes using a pH meter (Lutron pH-208) (Taiwan). Data obtained from this study were quantitative data, the amount of fluoride ion that release from bioactive resin.

Statistical analysis used the One-way ANOVA test with a confidence level of 95% (α = 0.05), followed by Post Hoc Dunnett's T3 analysis to determine the significance value.

RESULTS

The results of the study of the release of fluoride ion bioactive composite resin obtained the mean value presented in Figure 1.



	25%	50%	75%	100%	CHX	Aquadest
Mean (ppm)	6	3.22	2.31	2.29	2.31	1.85
SD	0.87	0.46	0.45	0.46	0.45	0.91
pH	5.73	5.21	5.05	4.95	7	7

Figure 1. The diagram of fluoride ion that release from bioactive composite resin mean value, standart deviation and pH of the solution.

Based on Figure 1, the highest number of bioactive composite resin fluoride ion release was highest in the group immersed in a mixed solution of mauli banana stem extract and basil leaf extract concentration of 25% (6.00 ± 0.87ppm) with a pH of 5.73, while the mean release of fluoride ion the lowest bioactive composite resin in the group immersed in distilled water (1.85 ± 0.91ppm) with a pH of 7. Immersion in a concentration of 75% and CHX had the same mean amount of fluoride ion release (2.31 ± 0.45ppm) with a similar pH different from both solutions. Overall groups, the amount of fluoride ion release decreased with increasing concentrations of the extract solution.

DISCUSSION

From the results of the study, all the immersions groups of bioactive composite resins experienced the release of fluoride ions. Many factors may affect the amount of fluoride ion release, one of which is caused by a pH difference. Based on research conducted, a mixture of mauli banana stem extract and basil leaf

extract concentrations of 25%, 50%, 75%, and 100% has a pH that is classified as more acidic than distilled water. The lowest fluoride ion release is presented in immersion with distilled water. The research of Moreaou and Hockin (2010) proves that immersion of restorative material containing fluoride in a solution with a pH of 4 would released amount of fluoride ion more higher compared with the same material if immersed in a solution with a pH of 7.[11] The acidity of the solution is due to the active substance contained in it.[14,15,16,17] The degree of acidity (pH) influences the release of ions.[18] Research of Tiwari et al (2015) has explained the process of releasing fluoride ions which begins with the effect of changing the pH of environment.[10]

The lowest acidity (pH) level is at a concentration of 100% with the least amount of fluoride ion release. Increasing number of ingredients in the mixed solution of Mauli Banana stem extract and basil leaves result in the solution have a higher viscosity. Viscosity is affected by particle size, particle count, and concentration. The greater the concentration of the solution, the greater the viscosity of the solution.[15,19] A solution with high viscosity is difficult to penetrate into the Bioactive Glass (BG) particles in the bioactive composite resin, therefore fluoride ions are released in small amount.[20]

The second reason that the least amount of fluoride ion is released in immersion at a concentration of 100% is the composition of the bioactive composite resin. The bioactive composite resin used is Activa ™ Bioactive Restorative (Pulpdent). The diurethane matrix in this resin has a urethane group (RNHCOOR-).[21,22,23] In this study, immersion of bioactive composite resin specimens was carried out at 37^{o}C in the incubator to adjust to the normal conditions of the oral cavity. Immersion at 37^{o}C may affect the molecular mobility of the polymer composite resin chain. The irradiation process of composite resins is not always optimal. About 35-45% of the monomers have not been completely polymerized. Molecules from the remaining un-polymerized residual monomer subsequently may experience mobilization and increase the formation of cross-linking .[24]

The least amount of fluoride ion release is found in immersion at 100% concentration is because of the BG content in bioactive composite resins. Based on Alrahlah et al (2018) fluoride ions in bioactive composite resins are contained in fillers in sodium fluoride compounds.[22,23] These resins also contain BG consisting of SiO_2, CaO, Na_2O, and P_2O_5. The water content in the solution will break down into H^+ and OH-, subsequently the Si-O-Si bond in the coupling agent is attacked by H^+ ions until the bond is released. The presence of free polymerized monomers and the presence of hydroxyl ions will form a silica-rich Si-OH layer. When the Si-OH group condenses, the silica-rich layer undergoes repolymerization, attracting calcium and phosphate ions to precipitate in the form of Amorphous Calcium Posphat (ACP), which then crystallizes into HA. The fluoride release must allow water to reach the BG particles and the ions must be able to get out of the structure of the bioactive composite resin.[20]

The limitation of this study is the environment that used was not in accordance with the actual state of oral cavity. Immersion in saline solution at 37^{o}C was carried out as an effort to optimize research to fit the physiological state of the oral cavity. This study also only did immersion at one time so that it was not yet able to find out whether there was a saturation time limit for the amount of fluoride ion release of bioactive composite resin. So, the conclusion is there is an effect of mauli banana extract (*Musa acuminata*) on the release of fluoride ion bioactive composite resin.

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