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Antimicrobial Activity Of Mouthwash Ethanol Extract of *Curcuma purpurascens* Bl. (Temu Blenyeh) as Affected by Sodium Lauryl Sulfate Concentration Variations

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ABSTRACT

Oral and dental health problems are usually caused by pathogenic microbes such as Streptococcus mutans and Candida albicans. Sodium lauryl sulfate is a foamer that can remove microorganisms in the oral cavity. Using mouthwash is considered the easiest and most effective because it can reach between the teeth. Therefore, the aim of this research is to create and see the effect of varying the concentration of sodium lauryl sulfate in mouthwash preparations of ethanol extract of temu blenyeh (*Curcuma purpurascens* Bl.) on inhibiting the growth of microbes such as *Streptococcus mutans* and *Candida albicans*. The results of testing the antimicrobial activity of mouthwash preparations against *Streptococcus mutans* bacteria were classified as very weak in formulation (0), namely 3.00 mm, then in the medium category, namely in formulation (I) 5.30 mm, formulation (II) 6.66 mm, and formulation (III) 10.33 mm, while the fungus *Candida albicans* is classified as very weak in formulation (0), namely 4.00 mm. Then it is classified as medium with an average diameter of the inhibition zone, namely formulation (I) of 5.53 mm, formulation (II) of 8.00 mm, and formulation (III) of 8.58 mm. From these results, it can be concluded that there is an effect of using varying concentrations of sodium lauryl sulfate in each formula on the antimicrobial activity of *Streptococcus mutans* and *Candida albicans*.

Keywords: Antimicrobial, Mouthwash, Sodium Lauryl Sulfate, Temu Blenyeh (*Curcuma purpurascens* Bl.)

ABSTRAK

Masalah kesehatan mulut dan gigi biasanya disebabkan oleh mikroba pathogen seperti *Streptococcus mutans* dan *Candida albicans*. Natrium lauril sulfat merupakan pembusa yang dapat mengeluarkan mikroorganisme pada rongga mulut, penggunan *mouthwash* dianggap paling mudah dan efektif digunakan karena mampu menjangkau sela-sela gigi. Maka dari itu tujuan penelitian ini adalah membuat dan melihat pengaruh variasi konsentrasi natrium lauril sulfat pada sediaan *mouthwash* ekstrak etanol temu blenyeh (*Curcuma purpurascens* Bl.) dalam menghambat pertumbuhan mikroba seperti *Streptococcus mutans* dan *Candida albicans*. Hasil pengujian aktivitas antimikroba sediaan *mouthwash* terhadap bakteri *Streptococcus mutans* tergolong sangat lemah pada formulasi (0) yaitu 3,00 mm, kemudian dalam kategori sedang yaitu pada formulasi (I) 5,30 mm, formulasi (II) 6,66 mm dan formulasi (III) 10,33 mm sedangkan pada Jamur *Candida albicans* tergolong pada kategori sangat lemah pada formulasi (0) yaitu 4,00 mm. Kemudian tergolong sedang dengan rata – rata diameter zona hambat yaitu formulasi (I) 5,53 mm, formulasi (II) 8,00 mm dan formulasi (III) 8,58 mm. Dari hasil tersebut dapat disimpulkan bahwa terdapat efek penggunaan variasi konsentrasi natrium lauril sulfat pada masing – masing formula terhadap aktivitas antimikroba *Streptococcus mutans* dan *Candida albicans*.

Kata Kunci: Antimikroba, Obat Kumur, Natrium Lauril Sulfat, Temu Blenyeh (*Curcuma purpurascens* Bl.)

INTRODUCTION

Oral and dental health problems, especially dental caries, bad breath, and canker sores, are still complained about by Indonesian people, both adults and children. According to Nurbiantia, Alhawarisb, and Sinar Yani (2021), dental caries problems in Indonesia reached 43.4%. Apart from Streptococcus mutans, which can cause dental caries, there are other microorganisms that grow in

the oral cavity, namely *Candida albicans*. *Candida albicans* is a fungus that causes canker sores (Qhorina et al., 2021).Mouthwash is a solution containing antimicrobial substances that is used to maintain cleanliness and freshness of breath in the oral cavity and overcome oral and dental health problems (Djafar et al., 2021). Widely circulated mouthwash contains 25% or more alcohol, which can increase the risk of mouth, throat, and pharynx cancer by up to 50% (Gurning et al., 2018). Another alternative that can reduce this risk is to use natural extracts, one of which is *Curcuma purpurascens* Bl. (Temu Blenyeh), which was previously studied by Laili Ratna N., T., and Pramiastuti O. (2023) and has antimicrobial activity against *Sreptococcus mutans* and *Candida albicans*. Based on this research, the ethanol extract of *Curcuma purpurascens* Bl. (Temu Blenyeh) at concentrations of 30; 40; 50; and 70% has an inhibition zone of 6.75; 7.00; 7.08; 7.16; and 8.26 mm against *Streptococcus mutans* and 2.75; 3.16; 3.33; 3.60; and 3.67 mm against *Candida albicans*. Apart from that, The results showed that Temu blenyeh had antibacterial activity against *Staphylococcus aureus* (gram-positive bacteria), *Escherichia coli* (gram-negative bacteria), *Bacillus subtilis*, and *Pseudomonas aeruginosa* (Rina Anggraini, Marniati Salim, 2013).

Temu blenyeh contains compounds such as flavonoids, saponins, tannins, alkaloids, terpenoids, and polyphenols, according to Sukmawati et al. (2013) Flavonoid and alkaloid compounds also have antibacterial activity. Saponin and steroid compounds are secondary metabolites that have antibacterial activity (Ramdani et al., 2020). In making mouthwash preparations, apart from the active substance, there are other ingredients, one of which functions as a surfactant. Surfactants are compounds that can reduce surface tension, one of which is sodium lauryl sulfate. Sodium lauryl sulfate is an anionic surfactant that functions to reduce surface tension, thereby dissolving ingredients that are difficult to dissolve in the formula. The mechanism of action of sodium lauryl sulfate itself is to bind dirt by reducing interfacial tension, forming a micelle layer (Surfactant-dirt), and then transporting it off the surface (Wardhana & Putra, 2023). Apart from being a surfactant, sodium lauryl sulfate functions as a detergent, which can remove microorganisms in the oral cavity (Backer, CA., Brink, R.C., & Bakhuizen Van Den, 1963). Based on research conducted by Laili and Pramiastuti (2023), the inhibition zone has been seen at the lowest concentration of 30%. Therefore, the researchers were interested in using the lowest dose and formulating it into a mouthwash preparation by adding varying concentrations of sodium lauryl sulfate to determine the effect on mouthwash of the ethanol extract of Temu blenyeh in inhibiting microbial growth.

RESEARCH METHODS

This research is experimental and was conducted at the Laboratory of Microbiology, Technology of Pharmaceutical Preparations and Natural Ingredients, Faculty of Health, Pharmacy Department, University of Bhamada Slawi.

Tools

The tools used in this study were measuring cups (pyrex), Erlenmeyer (pyrex), test tubes (pyrex), analytical balances (aeADAM), stirring rods, dropping pipettes, funnels, ovens (Gentra), mixers (Mitochiba), Beaker Glass (pyrex), petri dish (pyrex), petri dish (Normax), autoclave (Alamerican), incubator (Mammert IN 55), loop needle, micro pipette (ecopippette), mortar and steamer, glass jar, Mouthwash container, L rod, blender, Brookfield Viscometer, test tube rack, hot plate (nesco lab), waterbath (dss), homogenizer, porcelain crucible, centrifugation and centrifuge tube, disc paper, and pH stick.

Materials

The materials used in this study were temu blenyeh extract, aquadest, ethanol 96%, glycerin, sodium lauryl sulfate, sodium benzoate, sodium saccharin, Propylene Glycol, 5% DMSO, 0.2% chlorhexidine,

sodium agar (NA), potato dextrose agar (PDA), and MC solution. Farland, *Streptococcus mutans*, and *Candida albicans* ATC 0231 bacteria.

Sampling and processing

Temu blenyeh gathering was obtained from the UPTD WKJ Kalibakung, Balapulang Tegal Jawa Tengah. Making blenyeh Temu powder goes through several stages, namely wet sorting, washing, chopping, drying, and pollination (Handoyo & Pranoto, 2020)

Extract Manufacturing

Temu blenyeh extract was prepared by the maceration method using a 96% ethanol solvent. The choice of the maceration method is because the tools used are quite simple and safe to use for materials that cannot stand heating (Pratiwi & Ritonga, 2022). The maceration method is carried out by means of 500 grams of sifted Temu blenyeh powder, which is then put into the maceration vessel. Next, add 1.5 L of 96% ethanol and let stand for 3–24 hours in a closed vessel, protected from direct sunlight, and stirred periodically. Stirring is done with the aim of mixing the solvent with the powder of Temu blenyeh simplicia so that it will speed up the extraction time, the active substance can dissolve completely, and the resulting extract will be more potent (Syafa'ah et al., 2019). After 3 x 24 hours of filtering with filter paper number 1.96% ethanol is used because ethanol is a universal solvent that can attract various polar and non-polar compounds. Besides that, this solvent is safe to use because it has no toxic effects (D Chusniasih and T Tutik, 2021). According to Kurniawati, Maftuch, and Hariati (2016), the 96% ethanol solvent is a relatively concentrated solvent, so the use of this solvent will optimally attract the active substances contained in simplicia so that the results obtained will be greater.

The maceration residue was then re-macerated five times. Remaceration is carried out with the aim of withdrawing compounds that are still left behind during the maceration process. Apart from that, another advantage of maceration is that more extracts are obtained (Pujiastuti and El'Zeba, 2021). Furthermore, the filtrate resulting from the maceration and remaceration processes is combined and evaporated over a water bath to obtain a thick extract. The yield of the condensed extract was then calculated. The yield is the result of the ratio of the weight of the extract produced from the extraction process to the weight of the simplicia powder used; the higher the extract obtained, the greater the yield produced (Senduk, Montolalu, and Dotulong, 2020).

Formulation

The mouthwash preparation formula designed in this study can be seen in Table 1.

Table 1. Mouthwash formulations (Magfirah et al., 2023)

No.	Material	Utility	Composition				Range (%) Handbook Of Pharmaceutical Excipients
			F0 (%)	F1 (%)	F2 (%)	F3 (%)	
1	Temu Blenyeh 96% ethanol extract	Active substance	1.50	1.50	1.50	1.50	-
2	Glycerin	Konsolven	15.00	15.00	15.00	15.00	<20 (Page 283)
3	Propylene Glycol	Humektan	10.00	10.00	10.00	10.00	10 - 25 (Page 592)
4	Saccharin Sodium	Sweetener	0.60	0.60	0.60	0.60	0.60 - 0.075 (Page 608)
5	Sodium lauryl sulfate	Foaming agents and surfactants	1.00	1.50	1.75	2.00	1.00 – 2.00 (Page 631)
6	Sodium Benzoate	Preservative	0.10	0.10	0.10	0.10	0.001 – 0.10 (Page 627)
7	Menthol	Flavor	0.25	0.25	0.25	0.25	0.1 – 2.00 (Page 433)
8	Aquadest	Solvent	Ad 100	Ad 100	Ad 100	Ad 100	Ad 100

Information: (F0) Formula without extract & concentration of Sodium Lauryl Sulfate 1%; (FI): Formula with concentration Sodium Lauryl Sulfate 1,5%; (FII) Formula with concentration Sodium Lauryl Sulfate 1,75%; (FIII) Formula with concentration Sodium Lauryl Sulfate 2%

Mouthwash preparations were made by dissolving the extract with 10 mL of prophylene glycol and 10 mL of distilled water by vortexing for 5 minutes and then sonicating the extract at 70°C and 35 kHz for 10 minutes (Mixture 1) (Juniatik et al., 2022). Then dissolve the menthol with 96% ethanol first until it dissolves in Erlenmeyer (Mixture 2), then dissolve the sodium saccharin with 10 mL of water (Mixture 3). Then dissolve sodium lauryl sulfate and sodium benzoate with 20 mL of distilled water in Erlenmeyer by homogenizing using a homogenizer for 5 minutes, then adding mixture 2, homogenizing again for 2 minutes, then adding mixture 3, and homogenizing for 2 minutes. then add glycerin, homogenize again for 2 minutes, then add mixture 1, then homogenize again for 5 minutes. After the solution is homogeneous, it is sonicated again for 10 minutes, the preparation is filtered and put into a container, and then it is sufficient to the calibration limit of 100 mL using distilled water. Carry out this procedure for each formula, then evaluate the preparation.

Evaluation Test of Mouthwash Preparations

1. Organoleptic Test

Organoleptic tests are carried out by seeing and feeling with the sense of touch regarding the color, shape, and aroma of the preparation (Faradiba et al., 2012).

2. Homogeneity

The homogeneity test is carried out by observing the preparation that has been put into a clear bottle and then observed on a white background (Komala, Andini, and Zahra. 2020)

3. Foam Height Test

The foam height test is carried out with the aim of seeing the foam produced by surfactants. This test is done by shaking 10 mL of mouthwash in a measuring cup for 5 minutes, then measuring a stable foam height after 5 minutes (Syifa and Barlian. 2019)

4. pH test

The pH test was carried out by dipping the pH stick in the preparation and then comparing the pH stick with a pH meter. The pH of a good mouthwash is 5-7; if the pH obtained is <5, it will cause irritation because it is too acidic; if the pH is >7, it will cause the growth of fungi that cause canker sores because it is too alkaline (Djafar et al., 2021).

5. Viscosity Test

The viscosity test aims to determine the viscosity or flow properties of mouthwash preparations (Syifa & Barlian, 2019). Measurement of the viscosity of the preparation is carried out using a Brookfield viscometer by means of 50 mL of preparation in a beaker measured by a Brookfield viscometer using spindle number 1 at a speed of 100 rpm (Sulistiyono et al., 2022).

6. Sedimentation Test

The sedimentation test was carried out to see the physical stability of the preparation and to determine the deposition speed of the preparation (Yasir et al., 2020) The test was carried out by means of 2 mL of each preparation inserted into a test tube, then centrifuged for 30 minutes at a speed of 3000 rpm. The results of the sedimentation test are visually observed after the centrifugation process, whether or not separation occurs in each preparation.

Antimicrobial Activity Test of Mouthwash Preparations

1. Media Creation

Sodium agar (NA) media was prepared by dissolving 0.3 grams of beef, 0.5 grams of peptone, and 1.5 grams of agar in 100 mL of distilled water and then homogenizing on a hot plate (Fajrina et al., 2021). The preparation of potato dextrose agar (PDA) media was made by weighing 39 grams of potato dextrose agar (PDA) powder, putting it into a beaker glass, adding 1L of distilled water, and homogenizing by stirring until it boils on a hot plate. After homogeneous sterilization of the media with the autoclave at 121^{o}C for 15 minutes. The mixture that has been sterilized is then poured into a petri dish with a thickness of approximately 5 mm and left to stand until the NA media is solid (Novianti, 2016)

2. Equalization of microbial turbidity standards

The bacterial suspension is prepared by taking 2 oz of 24-hour-old bacterial colonies on an oblique agar and then inserting them into a test tube containing 10 mL of 0.9% NaCl, then mixing with a vortex. Furthermore, the turbidity of the suspension is compared with the standard solution of MC. Farland.

3. Antimicrobial Activity Test

After completion of bacterial culture on sodium agar media (NA) (Streptococcus mutans) and potato dextrose agar media (PDA) (*Candida albicans*), Next, the activated disc was immersed with various solutions (F0, F1, F2, and F3), as well as a positive control (*Chlorhexidine* 0.2%), then attached to a petri dish and incubated for 24 hours at 37°C.The presence of antimicrobial activity can be seen if a clear area is seen on the edge of the disc after incubation for 24 hours. This is because these microbes are stunted in growth, so the inhibition is measured in mm (Nurbiantia, Alhawarisb, and Sinar Yani 2021). Antibacterial activity testing was carried out three times (triplo) (Gurning et al., 2018).

RESULTS AND DISCUSSION

Collection and Determination of Plants

The specimen used in this study was Temu blenyeh (*Curcuma purpurascens* Bl.) from the *Zingiberaceae* family. The part used in this study was the rhizome. Furthermore, the rhizome was wet sorted, washed, chopped, dried, dry sorted, and crushed to obtain Temu blenyeh powder.

Table 2. Yield of dry simplicia and powder of temu blenyeh rhizome simplicia

No.	Sample	Initial weight (g)	Final weight (g)	Yield (%)
1	Wet rhizomes	7.000	-	-
2	Dried rhizomes	7.000	604.708	8.63
3	Simple powder	604.708	55.64	92.38

Extraction

The yield percentage of the condensed extract of the temu blenyeh obtained was 33.37%. The yield requirements for the condensed extract of Temulawak rhizome used refer to the requirements for thick extract of Temulawak rhizome (*Curcuma Xanthorrizae*) because Temu lawak is still in the same family as Temu blenyeh. These requirements are contained in the Indonesian herbal formulary, which is more than 18% (Depkes RI. 2017). The resulting yield is higher when compared to the research by (Pramiastuti & Murti, 2022), which obtained an extract yield of 19.33%. This is due to differences in treatment during the extraction process. The research conducted by Pramiastuti and Murti (2022) did not carry out remaceration and only went through the maceration process, while in this study the remaceration process was carried out five times.

Mouthwash Preparations

Mouthwash preparations are based on research conducted by Magfirah et al. (2023), which used turmeric extract as an active substance. This basis was chosen because there was no previous research that stated that Temu blenyeh could be formulated into mouthwash preparations; therefore, the selection of turmeric active substances was based on similarities among members of the Zingiberaceae family. as well as research from (Lidia, Darmacik, and Rikmasar (2020), which used varying concentrations of sodium lauryl sulfate as a surfactant that functions to homogenize the ingredients in the formula and helps remove microorganisms in the oral cavity. The selection of the 1.5-gram concentration of the active ingredient in the Temu blenyeh extract was based on research by Laili and Pramiastuti (2023), which stated that a concentration of 30% with an extract weight of 1.5 grams had antimicrobial activity. Apart from that, the selection This concentration was chosen in the hope of

minimizing the side effects caused by the active substance.

Evaluation Test of Temu Blenyeh Ethanol Extract Mouthwash

The organoleptic test results on the four liquid formulations and the odor of the F0 preparation were weak; only a distinctive menthol odor was detected, while the formulas I, II, and III had the characteristic odor of temu blenyeh and menthol. On F0, it had a slightly sweet and slightly spicy taste (cooling), while on FI, FII, and FIII, it had a distinctive taste of Temu blenyeh, slightly sweet and slightly spicy (cooling). In F1, FII, and FIII, there were no differences in the smell, shape, color, or taste of the preparations because the concentration of the extract used was the same, which distinguished each formula, namely the concentration of sodium lauryl sulfate (Lidia et al., 2020)

Table 3. *Mouthwash* organoleptic test results of Temu Blenyeh ethanol extract

No.	Formulation	Smell	Dosage forms	Color	Flavor
1	F0	Typical menthol	Liquid	Clear	Slightly sweet & slightly spicy (Cooling)
2	FI	Typical temu blenyeh & menthol	Liquid	Brownish orange	Typical temu blenyeh, A little sweet & a little spicy (Cooling)
3	FII	Typical temu blenyeh & menthol	Liquid	Brownish orange	Typical temu blenyeh, A little sweet & a little spicy (Cooling)
4	FIII	Typical temu blenyeh & menthol	Liquid	Brownish orange	Typical temu blenyeh, A little sweet & a little spicy (Cooling)

The pH obtained from all formulas is 6, which is the pH that corresponds to the pH of the mouth. The pH of mouthwash should not be much different from the pH of the mouth because it can cause irritation (Densi Selpia Sopianti, 2018). The results of the homogeneity test for all formulations were homogeneous, not cloudy, and free of contamination. The results of the homogeneity test can be concluded that the four formulations observed visually can be said to be good and meet the requirements because they comply with the requirements where the preparations are evenly mixed, not cloudy, and there is no contamination in the mouthwash preparations (Djafar et al., 2021).

The viscosity test was carried out with the aim of seeing the viscosity or flow characteristics of the mouthwash preparation (Syifa & Barlian, 2019). A good mouthwash viscosity is close to the viscosity of air, namely approximately ±1 cP, the closer the viscosity of the mouthwash preparation is to the viscosity of air, the easier and more comfortable the mouthwash preparation is to use for gargling. (Qhorina et al., 2021). The viscosity test of the ethanol extract of temu blenyeh mouthwash was carried out on day 0, namely the day the mouthwash was made. The research results showed that there were differences in viscosity values between formulations. According to (Hartono & Widiatmoko, 1993), this is due to the influence of additional ingredients that can affect the viscosity of a preparation, such as glycerin and propylene glycol. Apart from that, variations in surfactant concentration can also affect the viscosity of a preparation but do not affect the pH of the preparation (Wulansari et al., 2019). The results of the viscosity test table can be seen in Table 4.

The results of the sedimentation test for all formulas did not undergo separation and met the requirements for the sedimentation test for mouthwash preparations and can be said to have fulfilled the requirements.

The foam height test was carried out with the aim of seeing the foam produced by the surfactant, according to Syifa and Barlian (2019). From the table of foam height test results, it is proven that the higher the

concentration of surfactant used, the higher the foam produced, and the resulting clean power will be higher. This is because an increase in surfactant concentration will cause the formation of a complex micellar layer due to increased surfactant penetration into the surface layer, which can increase the cleaning ability of a preparation (Wardhana & Putra, 2023)

Table 4. Results of the viscosity test of the ethanol extract mouthwash of Temu Blenyeh

No.	Formulation	Viscosity Test Results			Average (m.Pa.s)	Literature
		R1 (m.Pa.s)	R2 (m.Pa.s)	R3 (m.Pa.s)		
1	F0	2.4	2.6	2.4	2.4	±1 cP (Qhorina et al., 2021)
2	FI	1.6	1.6	1.6	1.6	
3	FII	1.4	1.4	1.4	1.4	
4	FIII	1.3	1.3	1.3	1.3	

Table 5. Results of the Foam Height Test of the ethanol extract mouthwash of Temu Blenyeh

No.	Formulation	Foam Height Test Result			Average (cm)	Literature
		R1 (cm)	R2 (cm)	R3 (cm)		
1	F0	110	107	108	108,33	Stabil stelah 5 menit didiamkan (Syifa & Barlian, 2019)
2	FI	130	131	132	131	
3	FII	152	151	150	151	
4	FIII	190	189	190	189,66	

After testing the physical properties of the mouthwash preparation and getting the best results, the antimicrobial activity test of the preparation was then carried out. This test was carried out with the aim of knowing the antimicrobial activity produced by the mouthwash preparation of the ethanol extract of Temu blenyeh in inhibiting the growth of *Streptococcus mutans* and *Candida albicans* fungi. Chlorhexidine 0.2% was used as a positive control because it has good antibacterial activity in inhibiting microbial growth, especially in gram-positive bacteria such as *Streptococcus mutans* (Pambudi et al., 2021). The formula for the inhibition zone can be seen in Table 6.

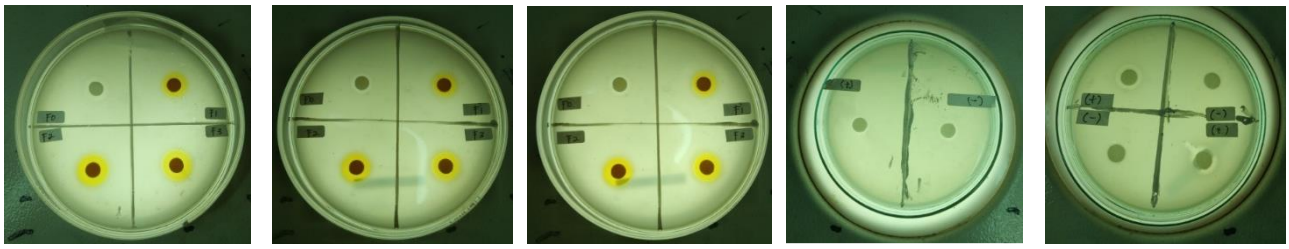
The inhibition zone produced by mouthwash from the ethanol extract of Temu blenyeh is yellow. This could be caused by the curcumin content in Temu blenyeh. Curcumin is a derivative of a phenolic compound that functions as an antimicrobial with a working mechanism that damages bacterial cell proteins, which causes leakage of cell nutrients, which results in inhibition of bacterial growth or death (Rini et al., 2018). In the research of Laili and Pramiastuti (2023). On testing the antimicrobial activity of Temu blenyeh extract, the inhibition zone produced was yellow, as well as in the research conducted by Apriliantisyah et al. (2022) on turmeric extract, which produced an orange-yellow color inhibition zone. From some of the literature, it is concluded that the resulting inhibition zone is not always clear; these results are influenced by the compounds contained in each test sample used.

Based on the results of this research, apart from being a surfactant, sodium lauryl sulfate was proven to have an influence on the inhibition zone produced by the ethanol extract mouthwash of temu blenyeh because, even though the concentration of the extract used in each formula was the same, there was an increase in the inhibition zone in each formula where F0 had the power. Barriers are classified as very weak, while in FI, FII, and FIII, there is an increase in the diameter of the

inhibition zone in the moderate category.

Table 6. Antimicrobial Activity Test of Ethanol Extract Mouthwash Preparation Temu Blenyeh on *Streptococcus mutans*

No.	Formulation	Antimicrobial Activity Test Results			Average (mm)
		R1 (mm)	R2 (mm)	R3 (mm)	
1	F0	3.00	3.00	3.00	3.00
2	FI	4.00	5.00	7.00	5.30
3	FII	6.00	7.00	7.00	6.66
4	FIII	9.00	11.00	11.00	10.33
5	Control (+)	5.00	5.00	5.00	5.00



(a) (b) (c) (d) (e)

Information: (a) Replication results 1 F0,F1,F2 & F3; (b) Replication results 2 F0, F1, F2 & F3; (c) Replication results 3 F0, F1, F2 & F3; (d) Results of replication 1 control (+) Chlorhexidine 0.2%; (e) Results of replication 2 & 3 control (+) Chlorhexidine 0.2%

Figure 1. Results of the antimicrobial activity test of mouthwash preparations against *Streptococcus mutans bacteria*

Table 7. Antimicrobial Activity Test of Ethanol Extract Mouthwash Preparation Temu Blenyeh on *Candida albicans*

No.	Formulation	Antimicrobial Activity Test Results			Average (mm)
		R1 (mm)	R2 (mm)	R3 (mm)	
1	F0	4.00	4.00	4.00	4.00
2	FI	5.60	5.00	6.00	5.53
3	FII	7.00	8.00	9.00	8.00
4	FIII	5.75	10.00	10.00	8.58
5	Control (+)	5.00	5.00	5.00	5.00

(a) (b) (c) (d) (e)

Information: (a) Replication results 1 F0,F1,F2 & F3; (b) Replication results 2 F0, F1, F2 & F3; (c) Replication results 3 F0, F1, F2 & F3; (d) Results of replication 1 control (+) Chlorhexidine 0.2%; (e) Results of replication 2 & 3 control (+) Chlorhexidine 0.2%

Figure 2. Results of the antimicrobial activity test of mouthwash preparations against *Candida albicans*

The results of the formula antimicrobial activity test on the Streptococcus mutans and *Candida albicans* also showed an increase in the inhibition zone in each formula with an increase in the level of variation in the concentration of sodium

lauryl sulfate. In a study conducted by Lidia, Darmacik, and Rikmasar (2020), mouthwash was made into 3 formulas with different concentrations of extract and sodium lauryl sulfate and increased in each formula, so that the resulting inhibition zone also increased. in which 11 formulas were made in this study, one of which was used for blanks, and the other 10 were made with 1 concentration of the same extract with varying concentrations of sodium lauryl sulfate. and increased in each formula, sodium lauryl sulfate was used as a solvent and reduced the turbidity of the formulation preparations, so that the inhibition zone results produced in this study showed an increase in the inhibition zone in each formula from formulation 1 to 9, but decreased in formula 10 due to sodium concentration. When too much lauryl sulfate is used, the results of the inhibition zone measurement have been reduced first with a blank inhibition zone. This indicates that the increase in sodium lauryl sulfate concentration has an effect on the resulting inhibition zone. Even though the mouthwash results from the ethanol extract of Temu blenyeh are said to meet the requirements of the physical evaluation test of the preparation and are proven to have antimicrobial activity, it is necessary to use different manufacturing methods to produce a clearer mouthwash preparation. Then it is necessary to carry out physical stability tests and isolate active compounds that have antibacterial and antifungal activity, as well as their inhibitory mechanisms.

CONCLUSION

Based on the research that has been carried out, it can be concluded that there is an influence of varying concentrations of Sodium Lauryl Sulfate on the antimicrobial activity of the ethanol extract mouthwash of Temu blanyeh (*Curcuma purpurascens* Bl.), where *Streptococcus mutans* is classified as very weak in formulation (0), namely 3.00 mm, then in the medium category, namely in formulation (I) 5.30 mm, formulation (II) 6.66 mm, and formulation (III) 10.33 mm, and *Candida albicans* is classified in the very weak category in formulation (0), namely 4.00 mm. Then it is classified as medium with an average diameter of the inhibition zone, namely formulation (I) of 5.53 mm, formulation (II) of 8.00 mm, and formulation (III) of 8.58 mm.

REFERENCES

Apriliantisyah, W., Haidir, Ki., Rasfayanah, Sodiqah, Y., & Said, M. F. M. (2022). Daya Hambat Ekstrak Kunyit (*Curcucma domestica* Val) terhadap bakteri Staphylococcus aureus dan Escherichia coli. *Fakumi Medical Journal: Jurnal Mahasiswa Kedokteran*, *2*(10). https://fmj.fk.umi.ac.id/index.php/fmj%0ADaya

Backer, CA., Brink, R.C., & Bakhuizen Van Den, J. (1963). *Flora of Java*. N.V.P Noordhoff Groningen The Netherlands.

D Chusniasih and T Tutik. (2021). Identification phytochemical compound of ethanol and acetone extract of Cocoa Pods (*Theobroma cacao* L.) using GC-MS. *Journal of Physics: Conference Series*, *1882*(1). https://iopscience.iop.org/article/10.1088/1742-6596/1882/1/012103/pdf

Densi Selpia Sopianti, D. W. S. (2018). Skrining Fitokimia Dan Profil KLT Metabolit Sekunder Dari Daun Ruku-Ruku (*Ocimum tenulflorum* L.) Dan Daun Kemangi (*Ocimum sanctum* L). *Jurnal Farmasi Dan Kesehatan*, *8*(1). https://doi.org/https://doi.org/10.36434/scientia.v8i1.118

Departemen Kesehatan Republik Indonesia, (2000). Umum Parameter Standar Ekstrak Tumbuhan Obat, Cetakan Pertama, 3-11, 17-19, Direktorat Jenderal Badan POM, Direktorat Pengawasan Obat Tradisional.

Kementerian Kesehatan Republik Indonesia (2017). Farmakope Herbal Indonesia (Edisi II) Jakarta: Kementerian Kesehatan Republik Indonesia.

Djafar, F., Paulina V.Y., Y., & Siampa, J. P. (2021). Mouthwash Formulation Of Water Hyacinth Extract (*Eichhornia crassipes* (Mart.) Solms) As An Antibiotics For Dental Caries (*Streptococcus mutans*). *Pharmacon Journal*, *10*(4). file:///C:/Users/ASUS/Downloads/jm_pharmacon,+152.+Fadillah+Djafar+(1169-1177).pdf

Fajrina, A., Bakhtra, D. D. A., Eriadi, A., Putri, W. C., & Wahyuni, S. (2021). Uji Aktivitas Antibakteri Ekstrak Etanol Rambut Jagung (*Zea mays* L.) Terhadap Bakteri Streptococcus mutans dan Porphyromonas gingivalis. *Jurnal Farmasi Higea*, *13*(2). http://www.jurnalfarmasihigea.org/index.php/higea/article/view/391/263

Faradiba, Pakki, E., Rusli, A., & Jabbar, A. (2012). Formulasi Masker Gel (Peel Off Mask) Sari Buah Tomat Apel (*Licopersicum esculentum* Mill). *As-Syifaa Journal*, *04*(02), 129–135. https://jurnal.farmasi.umi.ac.id/index.php/as-syifaa/article/view/77

Gurning, D., Nathaniel, D., Meila, O., & Sagala, Z. (2018). *Uji Aktivitas Antibakteri Sediaan Obat Kumur dari Ekstrak Etanol 70 % Batang Sambung Nyawa (Gynura procumbens (Lour .) Merr.) terhadap Bakteri Streptococcus mutans Antibacterial Activity of Longevity Spinach (Gynura Procumbens (Lour.)Merr.) Bark E*. *15*(2), 58–64. https://journals.ums.ac.id/index.php/pharmacon/article/view/5880/4568.

Handoyo, D. L. Y., & Pranoto, M. E. (2020). *Pengaruh Variasi Suhu Pengeringan Terhadap Pembuatan Simplisia Daun Mimba (Azadirachta Indica)*. *1*(2), 45–54. https://journal.ibrahimy.ac.id/index.php/tinctura/article/view/1546

Hartono, A. J., & Widiatmoko, M. C. (1993). *Emulsi dan Pangan Instan Berlesitin*. Andi Offset.

Juniatik, M., Hidayati, K., Wulandari, F. P., Pangestuti, N., Munawaroh, N., Martien, R., & Utami, S. (2022). Formulation Of Nanoemulsion Mouthwash Combination Of Lemongrass Oil (*Cymbopogon Citratus*) And Kaffir Lime Oil (Citrus *Hystrix*) against Candida Albicans ATCC 10231. *Traditional Medicine Journal*, *22*(1). https://journal.ugm.ac.id/TradMedJ/article/view/24255/15829

Komala, O., Andini, S., & Zahra, F. (2020). Uji Aktivitas Antibakteri Sabun Wajah Ekstrak Daun Beluntas (*Pluchea Indica* L.) Terhadap Propionibacterium Acnes. *Fitofarmaka Jurnal Ilmiah Farmasi*, *10*(1). https://journal.unpak.ac.id/index.php/fitofarmaka/article/view/1717/pdf

Kurniawati, I., Maftuch, & Hariati, A. M. (2016). Penentuan Pelarut Dan Lama Ekstraksi Terbaik Pada Teknik Maserasi *Gracilaria* Sp. Serta Pengaruhnya Terhadap Kadar Air Dan Rendemen. *Jurnal Ilmu Perikanan*, *7*(2). file:///C:/Users/ASUS/Downloads/306-Research Results-589-1-10-20190420.pdf

Laili, R. T. N., & Pramiastuti, O. (2023). *Antimicrobial Activity of Temu Blenyeh (Curcuma Purpurascens* Blume*) Ethanol Extract Against on Streptococcus Mutans and Candida Albicans*. *6*(1), 93–101. *Ad-da'wa Journal of Pharmaceutical Sciences.* doi: https://doi.org/10.24252/djps.v6i1.37703

Lidia, Darmacik, & Rikmasar, Y. (2020). Pengembangan Formulasi Sediaan Obat Kumur Ekstrak Daun Jambu Biji (*Psidium guajava* L.) dengan Variasi Konsentrasi Natrium Lauril Sulfat dan Sorbitol. *Jurnal Ilmiah Bakti Farmasi*, *1*. https://ejournal.stifibp.ac.id/index.php/jibf/article/view/62

Magfirah, F., Suwondo, A., Supriyana, Fatmasari, D., & Djamil, M. (2023). Potency Of Turmeric Extract Solution (*Curcuma Longa*) As An Alternative Herbal Mouthwash In Gingivitis Marginalis. *Healtsains Journal*, *4*(4). https://ejournal.unsrat.ac.id/index.php/JPKT/index

Novianti, D. (2016). Kemampuan Antifungi Ekstrak Rimpang Temulawak *(Curcuma Xanthorrhiza)* Terhadap *Candida Albicans*. *13*(2), 69–79.

Nurbiantia, A. A., Alhawarisb, & Sinar Yani. (2021). Daya Hambat Ekstrak Etanol Batang Akar Kuning (*Arcangelisia Flava* (L) Merr) Terhadap Pertumbuhan Bakteri Streptococcus Mutans, Porphyromonas Gingivalis dan Enterococcus Faecalis.". *Mulawarman Dental Journal*, *1*(2). https://e-journals.unmul.ac.id/index.php/MOLAR/article/view/5543

Pambudi, A. R., Wasiaturrahmah, Y., & Aspriyanto, D. (2021). Antibacterial Effectiveness Of Kecapi Sentul Extract (*Sandoricum Koetjape* Merr.) Against streptococcus mutans. Odonto Dental Journal. *Odonto Dental Journal*, *8*(2). https://jurnal.unissula.ac.id/index.php/odj/article/view/15903/6190

Pramiastuti, O., & Murti, F. K. (2022). Fitokimia dan Aktivitas Antioksidan Ekstrak Temu Blenyeh (*Curcuma purpurascens* Blumae). *Jurnal Ilmiah Kesehatan*, *15*(1), 12–22. https://jurnal.umpp.ac.id/index.php/jik/article/view/627/828

Pratiwi, A., & Ritonga, Z. H. (2022). Uji Aktivitas Antibakteri Rimpang Kunyit (*Curcuma Domestica* Val) Terhadap Bakteri Streptococcus Mutans. *Jurnal Farmasi*, *4*(2). file:///C:/Users/ASUS/Downloads/jfmeditor,+ASTI+4.2.pdf

Pujiastuti, E., & El'Zeba, D. (2021). Perbandingan Kadar Flavonoid Total Ekstrak Etanol 70% dan 96% Kulit Buah Naga Merah (*Hylocereus Polyrhizus*) Dengan Spektrofotometri. *Cendekia Journal of Pharmacy*, *5*(1). https://cjp.jurnal.stikescendekiautamakudus.ac.id/index.php/cjp/article/view/131/81

Qhorina, D. N., Prasetya, F., & Ardana, M. (2021). Formulasi Sediaan Mouthwash Ekstrak Daun Sirih Hitam (*Piper* sp.) Terhadap *Streptococcus mutans* dan *Candida albicans* Mouthwash. *Proceeding of Mulawarman Pharmaceuticals Conferences*, 228–236. https://prosiding.farmasi.unmul.ac.id

Ramdani, K., Mulqie, L., & Maulana, I. T. (2020). Eksplorasi Beberapa Tanaman yang Memiliki Aktivitas Antibakteri terhadap *Staphylococcus epidermidis* Penyebab Bau Badan. *Posiding Farmasi*, *6*(2). http://dx.doi.org/10.29313/.v6i2.23922

Rina Anggraini, Marniati Salim, dan E. M. (2013). Uji Bakteri Escherichia Coli Yang Resistan Terhadap Antibiotik Pada Ikan Kapas-Kapas Di Sungai Batang Arau Padang. *Jurnal Kimia Unand*, *2*(2). http://kimia.fmipa.unand.ac.id/images/Kimia/PDF/jurnalkimia/Volume2Nomor2Mei 2013.pdf

Rini, C. S., Rohmah, J., & Widyaningrum, L. Y. (2018). Efektivitas Kunyit (*Curcuma longa* Linn) terhadap Esherichia coli dan Bacillus subtilis. *Journal of Medical Laboratory Science/Technology*, *1*(1). http//ojs.umsida.ac.id/index.php/medicra

Senduk, T. W., Montolalu, L. A. D. Y., & Dotulong, V. (2020). The rendement of boiled water extract of mature leaves of mangrove Sonneratia alba. *Jurnal Perikanan Dan Kelautan Tropis*, *11*(1), 9. https://doi.org/10.35800/jpkt.11.1.2020.28659

Sukmawati, V. O., Ayu, I. D., Dewanti, R., Gigi, F. K., & Jember, U. (2013). Daya Antibakteri Dekokta Kulit Buah Delima Putih (*Granati Fructus Cortex*) Terhadap Streptococcus Mutans. *Artikel Ilmiah Hasil Penelitian Mahasiswa*. https://repository.unej.ac.id/bitstream/handle/123456789/59308/Vita Opica Sukmawati.pdf?sequence=1&isAllowed=y.

Sulistiyono, F. D., Almasyhuri, & Mukrim, R. F. (2022). Formulasi Sediaan Obat Kumur Kombinasi Ekstrak Daun Jambu Biji (*Psidium guajava* L.) dan Daun Pandan Wangi (*Pandanus amaryllifolius* Roxb.). *Chimica Et Natura Acta*, *10*(1), 22–25.

syafa'ah, n., rubiyanti, r., & aji, n. (2019). Pengaruh Pelarut Campur Etil Asetat Dan N-Heksan Terhadap Rendemen Dan Golongan Senyawa Ekstrak Biji Alpukat. *Media Informasi*, *15*(1). https://ejurnal.poltekkestasikmalaya.ac.id/index.php/BMI/article/view/226/182

Syifa, N. L., & Barlian, A. A. (2019). Tarub Terhadap Uji Sofat Fisik Sediaan Mouthwash Ekstrak Daun Sirih *(Piper betle L.)*. https://perpustakaan.poltektegal.ac.id/index.php/i0gx1r7h5ps/index.php?p=show_detail&id=13507&keywords=

Wardhana, M. G., & Putra, A. P. (2023). Formulasi Inovatif Shampo Minyak Bekatul Kabupaten Banyuwangi. *Jurnal Pendidikan Tambusai*, *7*(2). file:///C:/Users/ASUS/Downloads/astuti,+2251+FORMULASI+INOVATIF+17874-17878.pdf

Wulansari, S. A., Sumiyani, R., & Aryani, N. L. D. (2019). Pengaruh Konsentrasi Surfaktan Terhadap Karakteristik Fisik Nanoemulsi Dan Nanoemulsi Gel Koenzim Q10. *Jurnal Kimia Riset*, *4*(2), 143–151. https://e-journal.unair.ac.id/JKR/article/view/16164/9217

Yasir, A. S., Rai Saputri, G. A., & Chandra, Y. (2020). Formulasi Sediaan Kumur Ekstrak Etanol 96% Daun Seledri (*Apium Graveolens* L.) Sebagai Antibakteri Streptococcus Mutans Penyebab Bau Mulut. *Jurnal Farmasi Malahayati*, *3*(1), 1–11. https://doi.org/10.33024/jfm.v3i1.2433