



PROCEEDING

International Seminar Natural Product

The 2nd ISNP

Traditional medicines :

*"A Challenge in drug discovery from
natural resources"*

Grand Clarion Hotel Makassar
February 21st, 2015



Sekolah Tinggi Ilmu Farmasi Makassar
Akademi Farmasi Kebangsaan Makassar

EDITORS PROCEEDING
INTERNATIONAL SEMINAR OF NATURAL PRODUCT
The 2ndISNP
**“Traditional medicines;
A Challenge in drug Discovery from Natural resources”**

- Advisor : Kebangsaan Education Foundation
Drs. Sahibuddin A.Gani, Apt.
- Chairman : Besse Hardianti, S.Si, M.pharm, Sc., Apt.
Secretary : Reny Syahrani, S.Farm, M.Sc.
- Tim Editor : Prof. Dr. H. M. Natsir Djide, M.Si, Apt.
Prof. Dr. Gemini Alam, M.Si., Apt.
Subehan, S.Si., M.Pharm.Sc., Ph.D., Apt.
Dr. Mufidah, Msi, Apt.
Dr. Sartini, MS, Apt.
Drs. Burhanuddin Taebe, M.Si, Apt.
Dra. Jeanny Wunas, M.S., Apt.
Dra. Hj. Aisyah Fatmawaty, M.Si., Apt.
Wahyu Hendrarti, S.Si, M.Kes, Apt.
Nursamsiar, S.Si., M.Si.
Habibie, S.Si, M.Pharm.Sc. Apt.
Muh. Akbar Bahar, S.Si, M.Pharm.Sc. Apt.
Michrun Nisa', S.Farm., M.Sc.
Nur Khaeri, S.Si, M.Si, Apt.
Fitriyanti Jumaetri Sami, S.Si., M.Si.
- Setting Layout : Suharman, S.Sos.
Abdul Halim Umar, S.Farm., M.Si.
Syamsu Nur, S.Farm., Apt.
Fajriansyah, S.Farm., Apt.

DAFTAR ISI

	Halaman
Kata Pengantar Editor	i
Sambutan Ketua Yayasan Pendidikan Kebangsaan Makassar	ii
Tim Editor Prosiding Seminar Nasional Kefarmasian STIFA Makassar	iii
Daftar Isi	iv
Natural Product	
1. Identification And Determination Of Saponins Content In Extract Of Belimbing Wuluh (<i>Averrhoa Bilimbi</i> L.) Stem. <i>Jovie Mien Dumanauw, Adeanne Carolina Wullur, Oktaviani Wagiu</i>	1
2. Effect Of Sisik Naga Leaf Ethanolic Extract Concentration (<i>Drymoglossum Pillosooides</i> (L.) Persl.) On Inhibit Growth Of <i>Staphylococcus Aureus</i> . <i>Yos Banne, Juliet Tangka, Rizka Rahman</i>	5
Pharmaceutical Science	
1. Preparation Of Theophylline Nanoparticles By Ionic Gelation Technique Using Chitosan-Alginate And Its In Vitro Stability Test <i>Suryani, Henny Kasmawati, Sunandar Ihsan, Astrid Indalifiany</i>	11
2. Evaluation of physical stability and test the effectiveness of sunscreen cream combination extract temu kunci (<i>boesenbergia rotunda</i> (L.) Mansf.) With extract temu giring (<i>curcuma heyneana</i> val.) In vitro and in vivo <i>Maria Ulfa, Irmayani, Rista Puspita R</i>	17
3. Formulation And Physical Stability Testing On Pell Off Gel Mask And Cream Of Kacang Tunggak Sprout Extract <i>Nur Khairi, Maulita Indrisari</i>	23
4. Preparation Of Ulcer Ointment From Meniran (<i>Phyllanthus Niruri</i> L.) Herb Extract <i>B. I. Rumagit, Yos Banne, Yuningsih Dilampudi</i>	28
5. Preparation Of Natural Dye Powder From Terung Belanda Fruit (<i>Cyphomandra Betacea</i> Sent) <i>Selfie Petronela Joice Ulaen, Elfie R. Rindengan, Meydria Siska Rini</i>	34
6. Production Albumin Powder From Duck Egg Whites And Chicken Egg Whites Using Freeze Drying And Oven <i>Nurul Arfiyanti Yusuf, Aisyah Fatmawaty, Sharah Permatasari</i>	40
7. In Vitro Penetration Study of Albumin Emulgel Contains Oleic Acid as Penetration Enhancer <i>Aisyah Fatmawaty, Nurul Arfiyanti Yusuf, Andi Affandi</i>	48
Biochemistry	
1. Identification Retention Time Chlorpyrifos Methode Gas Chromatography In Cauliflower (<i>Brassica Oleracea</i>) Village Baroko <i>Asnah Marzuki, Agnes Lidjaja, Purnama M</i>	56
2. Synthesis Of Silver Nanoparticles Using Plant Media Of <i>Garcinia Mangostana</i> L. Extract And Antibacterial Activities <i>Fitriyanti Jumaetri Sami, Radhia Riski, Wahyu Hendrarti</i>	60
3. Synthesis Of Silver Nanoparticle With Reduction Method Using Extract <i>Curcuma Domestica</i> Val And Antibacterial Activity Test <i>Syamsu Nur, Fitriyanti Jumaetri Sami, Alimuddin Ali, A. Rahmat H</i>	65

4	Antioxidant Activities Of Sodium Sulfite (E-Hydroxy-S-Methoxy-Succinide) Cystoloseamine <i>Orhan Fikri, Akhmad Hani, Andri Abdillah</i>	72
5	A Comparative Study On Antioxidant Activity Of Rice Bran Oil (Oryza Sativa L.) From Three Rice Varieties (Champion, Capulis And Ciambang) Based Total Antioxidant Activity Using Total Antioxidant Capacity and The Ferric Reducing Assay	74
6	Test Antioxidant Activity And Acute Toxicity Test Methanol Extracts Laysan Shilbitung (C. <i>Leucodendron Uffingianum</i>, Ternate, Sula) <i>Siti Nurrahmah, (with Abdullah, Mulya) I. I. Tumbel</i>	78
7	Antioxidant Activities Relationship Of Stomach From Species Of <i>Polypodium Polypodioides</i> H. Againsts Carcinogenic Cells (Hep2 Cell Lines) <i>Sahar, Haryono, Adhikari, Nohong, Mariani, & Utungga, Irfan, Sholihah</i>	81
8	Study of Antioxidant Activity Of Black Candy Commensal Ginger (<i>Zingiber officinale</i> L. Var. <i>Rubrum</i> L.) Extract <i>Yu. Hana, Rizki, Subarman, Sigitra, Dan Hamid, Widiyanti, Andriana, Dwi Nurra</i>	97
Pharmacology		
1	Effective test of the Gussa Leaf gel for Burn Healing using rabbits with variation Carbomer[®] as gelling agent <i>Mahdi Indriani, Yui Elan</i>	97
2	Effectiveness Test Of Trembesi (<i>Samania Saman</i>) Leaves Extract Gel Againsts Burn Wound Healing On Rat (<i>Rattus Norvegicus</i>) <i>Rober, Teguh, Widayanti, Abdulhadi, Fenny Lani</i>	106
3	Effectivity Test Of Binuhong Leaf Extract (<i>Anrodera Cordifolia</i> (Ten) Steenis) Ointment On Wound Healing In Rats (<i>Rattus Norvegicus</i>) <i>Elizabeth Harung, Yui Elan, Angelen, & Wulan</i>	111
4	The Comparison Between Honey And Povidon Iodine In Perineum Wound Healing Of Postpartum Mother In RS Amanda Yogyakarta <i>Diah Wulandari, Widya Dwi Astuti</i>	116
5	Paliss Leaf (<i>Elettaria Hospitalis</i>) Extract Can Prevent Hepatotoxicity Induced By Chronic Use Of High Dose Paracetamol <i>Yulis Yusrin Dyah, Aryah Aryad, Slama Indarti</i>	123
6	The Topical Anti-Inflammatory Activity Of Methanol Extract Of <i>Cavendishia Orchitoides</i> Gaertn Rhizome On Rats Paw Edema Inducted By Carrageenan <i>Wahy Hendarti, Nursamira, Jeany Wulan, Isahrie</i>	127
7	Toxicity Effect of <i>Carthamus tinctorius</i> Linn. Aqueous extract on normal vero cell <i>in vitro</i> <i>Rahmawati Syahri, Lily Wahyudin, Gemin Elan, and Lailiana M</i>	134
8	Description Of Potential Drug Interactions On Patient With Hepatic Impaired In RSUD Dr. Soekardjo, Tasikmalaya <i>Ihsan Alfian, Akrom, Rahma Nurmayanti</i>	138
9	Memory-enhancing effect of aqueous extract of <i>Centella asiatica</i> on diazepam-induced amnesia model <i>in rats</i> <i>Nusarwan, Usma, Pratin, & Ariamun, I</i>	143
10	Potency Of Methanol Extract Of <i>Cavendishia Nappus</i> L. Lignum As Inhibition Growth Of <i>Aphyobacterium Tuberculosus</i> White Drug <i>Rizkistari, Wahy Hendarti, & Indriah, Andri Abdillah, Bachsan, Andriana</i>	148

**EFFECT OF SISIK NAGA LEAF ETHANOLIC EXTRACT CONCENTRATION
(*Drymoglossum piloselloides*(L.) Presl.)
ON INHIBIT GROWTH OF *Staphylococcus aureus***

Yos Banne, Juliet Tangka, Rizka Rahman
Jurusan Farmasi Politeknik Kesehatan Kemenkes Manado
Email : yosbanne_2518@yahoo.com

Abstract

Sisik Naga is an epiphytic plant contains saponins, polyphenols, essential oil, triterpene or sterols, phenols, flavonoids, sugars, and tannins. This plant has many benefits such as its water stew can be used to treat ulcers, arthritis, pulmonary tuberculosis with cough with phlegm, breast cancer, urinary tract infections, pelvic inflammatory and cancer. The aim of this study was to determine the inhibition growth effect and the different concentrations (1%, 2%, and 3%) effect of Sisik Naga leaf ethanolic extract on inhibit growth of *Staphylococcus aureus*. This is a laboratory experiment with Post Test Only Control Group design. Samples were Sisik Naga leaves collected from Malalayang Manado. Extraction process conducted with maceration method by using ethanol 70% as the solvent. The ethanolic extract made as solution test with concentrations of 1%, 2%, and 3% and then performed tested on *Staphylococcus aureus*. The diameter of inhibition zone observed every 1 x 24 hours, 2 x 24 hours, 3 x 24 hours. The data were analyzed descriptively and continued with One Way Anova. The results showed that Sisik Naga leaves ethanolic extract have the inhibitory effect and there is an influence of different concentrations of ethanolic extract to inhibit the growth of *Staphylococcus aureus*.

Keywords: Sisik Naga Leaf Ethanolic Extract, Inhibitory test, *Staphylococcus aureus*

INTRODUCTION

Indonesia has natural resources such as plants that have benefits in traditional medicine. One of the plants that can be utilized by the community as traditional medicine is sisik nagaleaf (*Drymoglossum piloselloides* (L.) Presl.). Sisik naga is an epiphytic plant that grows wild in the branches of trees, it can be found in the surrounding environment. Sisik naga contains saponins, polyphenols, essential oils, triterpenes/sterols, phenols, flavonoids, sugars, and tannins. This plant has many benefits, among others, the stew can treat ulcers, rheumatism, lung tuberculosis with a productive cough, cancer breast, urinary tract infections, pelvic inflammation and cancer (Hariana, 2011)

Research conducted by Rizka, et al (Rizka et al, 2012), states that the sisik naga

leaves have antibacterial activity against *Escherichia coli* and *Staphylococcus aureus*. The study was conducted using maceration method and ethanol 70 % as the solvent at a concentration of 2%. The results showed that, sisik naga leaf ethanol extract has antibacterial activity with inhibition of the bacteria *Escherichia coli* (6 mm) and *Staphylococcus aureus* (19 mm). This study using *Staphylococcus aureus* because the inhibitory effect of the extract on this bacteria according to the last research is greater than *Escherichia coli*, and this bacteria can easily found, for example in the wound.

Staphylococcus aureus is a spherical cell with a diameter of 1 μm , arranged in the form of irregular clusters (Brooks et al, 2005). *Staphylococcus aureus* is a human normal microflora, can be found in the nose,

skin, eyes, intestines, and liver but if the immune system decreased, these bacteria can cause infection. These bacteria can also be found in the air and the surrounding environment (Syarurachman et al, 1994).

Based on the description above, the problem in this study are whether the ethanolic extract of sisik naga leaf at concentrations 1%, 2%, 3% have inhibitory effect on the growth of *Staphylococcus aureus* and whether there is the effect of different concentrations (1%, 2%, 3%) of sisik naga leaf ethanolic extract to inhibit the growth of *Staphylococcus aureus*? The aim of this study was to determine the inhibition growth effect and the different concentrations (1%, 2%, and 3%) effect of Sisik Naga leaf ethanolic extract on inhibit growth of *Staphylococcus aureus*.

MATERIAL AND METHODS

Tools: autoclave, analytical balance, blender, flasks, test tubes, measuring cups, glasses Bekker, spiritus lamp, stir bar, tweezers, needle inoculation (ose), petri dish, aluminum foil, jars, rotary evaporator, caliper.

Materials: ethanol 70%, tween 80, aqua pro injection, nutrient agar, pure cultures of *Staphylococcus aureus*

Research Methods

The type of study is a laboratory experiments with Post Test Only Control Group design with the draft as follows:

Group 1 : P1----O1

Group 2 : P2----O2

Group 3 : P3----O3

Group 4 : P4----O4

Specification:

P1 = negative control; P2 = sisik naga leaves ethanolic extract at concentration 1%; P3 = sisik naga leaves ethanolic extract at concentration 2%; P4 = sisik naga leaves ethanolic extract at concentration 3%

O1 = inhibition zone of negative control;

O2 = inhibition zone of sisik naga leaves

ethanolic extract at concentration 1%; O3 = inhibition zone of sisik naga leaves ethanolic extract at concentration 2%; O4 = inhibition zone of sisik naga leaves ethanolic extract at concentration 3%.

Procedure

- Sterilization of instruments: in the autoclave at the temperature 121°C for 15 minutes.
- Preparation of simplisia :sisiknaga leaves were collected, washed with water, chopped, dried aerated in a place not exposed sunlight, then smoothed by using a blender.
- Preparation of sisiknaga leaf extract (Depkes RI, 1995; Harborne, 1987): using maceration method by weighing 50 g of sisiknagasimplisia included in the container and soaked in 70% ethanol as much as 350ml. The container is closed and left for 5 days while occasionally protected from light, stirred and then filtered. Dregs rinsed with 70% ethanol to obtain maserat 500 ml. The container is closed and left in a cool, sheltered from sunlight for 2 days and then filtered. Maserat filtered and then put in a round bottom flask, then concentrated in a rotary evaporator and evaporated to obtain a thick extract.
- Preparation of test solution: the test solution at concentration 1% prepared by weighing 0.1 g sisiknaga leaf extract was then added with 0.5% tween 80 and aqua pro injection to 10 ml. The test solution at concentration 2% prepared by weighing 0.2 g sisiknaga leaf extract was then added with 0.5% tween 80 and aqua pro injection to 10 ml. The test solution at concentration 3% prepared by weighing 0.3 g sisiknaga leaf extract was then added with 0.5% tween 80 and aqua pro injection to 10 ml.
- Preparation of nutrient agar medium (Pelczar & Chan, 2007): Nutrient agar weighed to 1 g, then dissolved in 50 ml distilled water, heated until a clear solution of nutrient agar while stirring,

then sterilized in the autoclave at a temperature of 121°C for 15 minutes. Poured into 3 sterile petri dishes each containing 15 ml. Let out for a moment until it becomes solid.

- Inoculation of bacteria from pure cultures of *Staphylococcus aureus* (Pelczar & Chan, 2007): incandescent the ose until red and then cooled slightly until the red color disappeared. Take the pure cultures of *Staphylococcus aureus* with sterilized ose, suspended with aqua pro injection in a test tube. Cotton buds dipped into a test tube containing the bacteria *Staphylococcus aureus* then smeared across the surface of the media that have been solidified evenly.
- Testing: Soaked paper discs at each concentration of 1%, 2%, 3% and a negative control for 5 minutes, then the paper discs were taken with tweezers and placed in petri dishes containing nutrient agar medium inoculated with *Staphylococcus aureus*. Incubated in the incubator at a temperature of 37°C, observed and measured the diameter of inhibition zone formed around the disc using a caliper every 1 x 24 hours, 2 x 24 hours, 3 x 24 hours.

RESULT AND DISCUSSION

Result

Research on the effect of the concentration of 1%, 2%, and 3% sisik naga leaf extract in inhibiting the growth of *Staphylococcus aureus* has been done. The extraction of 30 g sisik naga leaves with 300 ml ethanol 70% thick extract obtained as 5.1 g with a yield of 17%. Research results in the form of inhibition zone diameter measurement data can be seen in Table 1 below.

Table 1. Observation Data Inhibition Zone Diameter (mm)

Test Solution	Petri dish code	Observation Data Inhibition Zone Diameter (mm)		
		1 x	2 x	3 x 24

		24 hours	24 hours	hours
Negative control	I	0	0	0
	II	0	0	0
	III	0	0	0
	Mean	0	0	0
Concentration 1 %	I	1	1	1
	II	1	1	1
	III	1	1	1
	Mean	1	1	1
Concentration 2 %	I	6	6	6
	II	8	8	8
	III	8	8	8
	Mean	7,33	7,33	7,33
Concentration 3 %	I	6	6	6
	II	3	3	3
	III	1	2	2
	Mean	3,33	3,67	3,67

To confirm the inhibitory effect of sisik naga leaf ethanolic extract concentration influence the data analysis followed by one way ANOVA test Statistically and obtained the following results.

Table 2. Results of Test One way Anova ANOVA

Diameter	Sum of Squares	Df	Mean Square	F	Sig
Between Groups	94.020	3	31.340	61.957	.000
Within Groups	4.047	8	.506		
Total	98.067	11			

*. The mean difference is significant at the 0,05 level.

To determine differences in concentrations 1%, 2%, and 3% of sisik naga leaves ethanolic extract (*Drymoglossum piloseloides* (L.) Persl.) on the inhibition of bacterial growth, Post Hoc test held and the result can be seen in table 3

Table 3. Results of Post Hoc Test Multicomparison

Dependent Variable diameter zona bening

LSD

	(I) Larutan Uji	(J) Larutan Uji	Sig
Tukey LSD	Kontrol Negatif	Konsentrasi 1 %	.123
		Konsentrasi 2 %	.000
		Konsentrasi 3 %	.002
	Konsentrasi 1 %	Kontrol negatif	.123
		Konsentrasi 1 %	.000
		Konsentrasi 2 %	.023
	Konsentrasi 2 %	Kontrol negatif	.000
		Konsentrasi 2 %	.000
		Konsentrasi 3 %	.002
	Konsentrasi 3 %	Kontrol negatif	.023
		Konsentrasi 1 %	.000
		Konsentrasi 3 %	.000
		Kontrol negatif	.000
		Konsentrasi 1 %	.000
		Konsentrasi 2 %	.000

*. The mean difference is significant at the 0,05 level

Discussion

Research on the effect of sisik naga leaves ethanolic extract (*Drymoglossum piloseloides* (L.) Persl.) to inhibit the growth of *Staphylococcus aureus* has conducted. Sisik naga leaves contain saponins, polyphenols, essential oils, triterpenes / sterols, phenols, flavonoids, sugars, and tannins. This plant has many benefits, among others it can treat ulcers, rheumatism, tuberculosis of the lungs with a productive cough, breast cancer, urinary tract infections, pelvic inflammation and cancer (Hariana, 2011).

Sisik naga leaves are extracted using the maceration method with 70% ethanol as the solvent. This solvent has been chosen because it is miscible with water in any ratio,

and can dissolve flavonoids. Ethanol will extract potentially polar compounds such as antibacterial flavanoid, tannins, and saponins. Test solution preparation using tween 80 0.5% to mix the extract homogeneously.

Previous research using only one concentration, ie 2%, whereas in this study made three variations of concentration to see the effect of different concentrations on the inhibitory effect against bacteria and to determine the concentration which has the greatest effect of inhibition.

The observations in Table 1 indicate that the sisik naga leaves ethanolic extract at concentration 1%, 2%, and 3%, have inhibitory effects on the growth of *Staphylococcus aureus* with the diameter of inhibition zone formed around the paper disc on the observation for 3 x 24 hours. Negative control showed no inhibition zone diameter. At a concentration of 1% had a mean diameter of 1 mm inhibition zone and no increase in the diameter of inhibition zone for 3 x 24 hours. Concentration of 2% had a mean diameter of 7.3 mm inhibition zone and there is no inhibition zone diameter changes during the observation period. The concentration of 3% gives the average diameter of the inhibition zone varies. In observation of 1 x 24 hour average of 3.33 mm, next at 2 x 24 hour observation and 3 x 24 hours an increase in the mean diameter of the inhibition zone is 3.67 mm.

The results showed that the concentration of 1% has the smallest effect on inhibitory zone with diameter of 1 mm, while the concentration of 2% had the greatest inhibitory effect. These results indicate that the differences in the concentration of the extract yield different diameter of inhibition zone. This occurs because of the increased concentration of the extract led to the greater number of antimicrobial compounds that diffuse into the agar so that the zone of inhibition is expected to increase, however, the size of the zone of inhibition depends also on the

rate of diffusion of antimicrobial compounds used. Extract concentration continuously improved causes diffusion ability of antimicrobial compounds present in the extract will decrease as more viscous extract and as a result the size of the inhibition zone diameter tends to decrease. This can be seen in the inhibition zone resulting from a concentration of 2% greater than the concentration of 3%.

The difference in the average diameter of the inhibition zone between the treatment groups statistically analyzed by one way ANOVA test can be seen in Table 2, and it showed that Fh value of 61.957 with significantly by α ($0.000 < 0.005$). With Ftable value of 4.07. Value of $F > F$ table ($61.957 > 4.07$), so H_0 rejected and H_1 accepted, showed there is inhibitory effect of sisik naga leaf ethanolic extract at concentration 1%, 2%, 3% to the growth of *Staphylococcus aureus*. Post Hoc test results in Table 3, show that there is the effect of different concentration of 1%, 2%, and 3% of Sisik naga leaves ethanolic extract in inhibiting the growth of *Staphylococcus aureus*. However, on the negative control and a concentration of 1% was not significantly different in inhibiting the growth of *Staphylococcus aureus*.

Antibacterial activity found in sisik naga leaf extract due to the compound contained in the leaves of sisik naga. In general, the inhibition of bacterial growth related with the content of secondary metabolites such as saponins, tannins, and flavonoids. Mechanism of action of saponins will disrupt the cell wall surface tension, the surface tension of the solid when disturbed will antibacterial agent with easy entry into the cell and will interfere with the metabolism until there was inhibition of bacterial growth. Flavanoid

3. Brooks, G. F., J. S. Butel and S. A. Morse. Medical Microbiology. Mc Graw Hill, New York. 2005.
4. Syahruracman, A., Aidilfiet, C., Mediastuti, H.W., Lintong, M., Triyatni

compounds have a role as antimicrobial and antiviral. Flavonoids are phenolic compounds that can mendaturasikan proteins by interfering with cell wall permeability bacteria. The mechanism of inhibition of tannin that is the way the walls of bacteria that have been filled due to tannin can easily fit into a bacterial cell and bacterial cell protoplasm mengkoagulasi (Karlina et al, 2013).

CONCLUSION

Based on the research that has been done, it can be concluded that:

1. Sisiknaga leaf ethanolic extract at concentration of 1%, 2%, and 3% have inhibitory effects on the growth of *Staphylococcus aureus*.
2. There is effect of different concentrations of 1%, 2%, and 3% sisik naga leaf ethanolic extract on the growth of *Staphylococcus aureus*.

Suggestion

Needed to do more research on the effects of inhibition of sisik naga leaf on the growth of other bacteria.

References

1. Hariana, A. Tumbuhan Obat dan Khasiatnya Seri 3. Penebar Swadaya. Jakarta. 2011.
 2. Rizka, R., Nashrianto, H., Aminingsih, T. Kajian Identifikasi Senyawa Dalam Ekstrak Etanol dan Fraksi Etil Asetat Daun Sisik Naga (*Drymoglossopiloselloides*) dengan GC-MS dan Uji Aktivitas Antibakteri. Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Pakuan Bogor. Bogor. 2012.
- Soebandrio, A., Kurniawati A., Santoso, Hasrul, H., Bela, B., Soemarsono, F., Rahim, A., Karsinah, H., Isjah, L., Moehario, H.L., M., Asmono, N., Sudarmono, P.,

- Sastrosoewignjo, I.R., Utji, R., Sardjito, R., Suharno, J., Suharto., Sumaatmadja, S., Sujudi., Assani, S., Hutabarat, T., Mirawati, S.T., Warsa, C.U. Mikrobiologi Kedokteran Edisi Revisi. Penerbit Binarupa Aksara. Jakarta. 1994.
5. Departemen Kesehatan RI. Farmakope Indonesia. Edisi IV. Jakarta. 1995.
 6. Harborne. J. B. Metode Fitokimia. Penerbit ITB Bandung. Bandung. 1987.
 7. Pelczar, M.J dan Chan, E.C.S. Dasar-dasar Mikrobiologi. Universitas Indonesia Press. Jakarta. 2007.
 8. Karlina, C. Y., Ibrahim, M., Trimulyono, G. Aktivitas Antibakteri Ekstrak Herba Kr okot (Portulaca oleracea L.) terhadap Staphylococcus aureus dan Escherichia coli. Jurnal Lantera Bio. 2 (1:92). 2013