PROJECT ID:

ENV2044

TITLE:

THE POTENTIAL OF " BINJAR " AS A BIODETERGENT AND PHYTOREMEDIATION AGENT FROM BINAHONG LEAF (Anredera cordifolia), MUSTARD GREENS (Brassica juncea),

KEYWORDS:

Binahong leaf, mustard green, yellow root, biodetergent,

phytoremediation

AGE OF STUDENT(S):

16/17

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ABSTRACT

The majority of Indonesian people use detergents to clean clothes, household appliances, and so on. Over time, the use of detergents in Indonesia has increased drastically. One effort to prevent water pollution that is caused by detergent disposal is using a bio detergent from binahong leaf, mustard green, and yellow root. Binahong leaf is known to be rich in saponin, mustard green is one of the plants that can be used for phytoremediation, yellow root also has a saponin component that can be utilized as bio-detergent. The methods used were; make extracts of binahong leaves, mustard greens, and yellow roots with a mass of 10, 20, and 30 grams; make BINJAR (mixtures of the extracts of binahong leaves, mustard greens, and yellow roots) with each mixture mass of 10, 20, and 30 grams; perform the tests: foam stability, pH, organoleptic, detergency, and phytoremediation test on all samples. Yellow root with 30 grams have the best result regarding its foam stability, measuring at exactly 64.3%. Meanwhile Binjar 30 has the highest foam stability among the other different masses of mixtures, which is 56,25%. Whereas, the highest pH rate belongs to Binjar 30 with 6 and Binahong 30 grams with 5.9 pH rate. For the organoleptic test all the samples range from brown to green in color and have either bland or bitter taste.The best detergency result was binahong leaf extract that can maintain the fabric's original color. Yellow roots have good foam stability to be a biodetergent. On the other hand, mustard green is able to be a phytoremediation agent. Hence, mixing them brings out the best. Binahong leaves and yellow roots are able to make the foams due to their saponin content. In addition, mustard greens take parts as heavy metal phytoremediation agent considering its flavonoid content.

Keywords: Binahong leaf, mustard green, yellow root, biodetergent, phytoremediation

CHAPTER I INTRODUCTION

A. Background

The majority of people around the world use detergents as a means of cleaning clothes, household appliances, and so on. Over time, the use of detergents in the world has increased drastically. Detergents are widely used for industrial and domestic purposes (Mousavi and Khodadoost, 2019). Water pollution comes from various industrial and domestic discharges (Nie *et al.*, 2017). In the case of industrial pollutants, most of the water pollution is caused by the manufacture and use of detergents. Such pollution is harmful to human health and natural ecosystems (Mousavi and Khodadoost, 2019).

Generally, the problem of high amounts of detergent concentration in the water environment is caused by the formation of foam layers in the water surface. The event is an outcome of flawed surfactants' decomposition forasmuch surfactants can only decompose in a certain condition. This condition can decrease the incoming rate of oxygens from the air into the water so that it disrupts the absorption of dissolved oxygens. It is causing more complex water pollution. The components of detergent are considerably influencing the water ecosystem since it is capable to change both physical and chemistry's water parameters, such as alkalinity, pH, hardness, Iron (Fe), Copper (Cu), Bromine (Br), Lead (Pb), nitrate, nitrite, Chlorine (Cl), Fluoride, Sulfate, Mercury (Hg), and Chromium (Cr). Bad quality of water is also able to cause the changing of fishes' physically, chemistry, and biologically that will lead to affect the quantity of dissolved oxygens and increase metal's level in the water (Rajan, 2015).

One of the efforts to prevent water pollution that is caused by detergent disposal is using a biodetergent. Biodetergent is a detergent that does not contain harmful chemical components, the compositions themselves are not only environmental and economical friendly, but also adequate on cleaning stains and dirts. Overall, this research intends to create biodetergent through natural friendly ingredients, especially for water areas that are polluted by heavy metals (Ali, Khan and Sajad, 2013).

Biodetergent is made by utilizing natural elements so that if it comes back it will bring positive effects to the environment. The making of biodetergent can be used from plant resources. Beforehand, there was similar research regarding the identification of saponin contents in red cambogia extract. The research was still studying and sorting the most suitable solvent according to saponin's trait, such as using water solvent, ethanol, and propilen glikol. Unlike the previous research, this research is using the most polar solvent, which is water or aquades in order to identify saponin better (Nurzaman, Djajadisastra and Elya, 2018). In another research, avocado's seed can be used as a detergent, while it also wields for avocado's cultivation (Damayanti *et al.*, 2015). In brief, this research does not use any plant seed, yet ply another part of the plant that has not been processed, which is leaf.

Some of the natural resources that can be used to produce biodetergent are binahong leaf, mustard green, and yellow root. Binahong leaf is known to be rich in saponin, which is the chemical component to establish foam that is used as cleaner. The yellow root also has a saponin component, tanin, alkaloid, and flavonoid that can be utilized as biodetergent.

Phytoremediation is a plant-based technology which uses both naturally or genetically plant modification with the purpose to restore the land and water (Muthusaravanan *et al.*, 2018). Phytoremediation itself has the ability to decrease the

heavy metals pollutants in water. Hence, phytoremediation is considered to be a good solution to environmental issues due to its affordable prices, efficient, interesting, eco-friendly, and publicly accepted technology (Ali, Khan and Sajad, 2013).

Research stated that one of phytoremediation varieties, which phytodegradation is able to do in green leafy vegetable plants (Ali, Khan and Sajad, 2013). One of the plants that can be used for phytoremediation is mustard green. Therefore, mustard green is the feature used in this research. Since it is globally known to be a leafy vegetable, mustard green is also environmentally friendly and widely spread (Agwaramgbo *et al.*, 2012).

Hence, research will be necessary in order to know "The Potential of Binahong Leaf (*Anredera cordifolia*), Mustard Green *(Brassica juncea)*, and Yellow Root (*Fibraurea chloroleuca*) as Biodetergent and Phytoremediation Agent to Prevent Water Pollution".

B. Problem Formulation

1. How is the potential of binahong leaves from 10, 20, and 30 grams with the ratio of plants and solvents 1:10 as biodetergent and phytoremediation agent?
2. How is the potential of mustard greens from 10, 20, and 30 grams with the ratio of plants and solvents 1:10 as biodetergent and phytoremediation agent?
3. How is the potential of yellow roots from 10, 20, and 30 grams with the ratio of plants and solvents 1:10 as biodetergent and phytoremediation agent?
4. How is the potential of a mixture of binahong leaves, mustard greens, and yellow roots (Binjar), each with a mass of 10, 20, and 30 grams with a ratio of plant and solvent 1:10 as a biodetergent and phytoremediation agent?

C. Research Purposes

1. Knowing the potential of binahong leaves with masses of 10, 20, and 30 grams with a ratio of plants and solvents 1:10 as a biodetergent and phytoremediation agent.
2. Knowing the potential of mustard greens with masses of 10, 20, and 30 grams with a ratio of plants and solvents 1:10 as a biodetergent and phytoremediation agent.
3. Knowing the potential of yellow roots with masses of 10, 20, and 30 grams with a ratio of plants and solvents 1:10 as a biodetergent and phytoremediation agent.
4. Knowing the potential of a mixture of binahong leaves, mustard greens, and yellow roots (Binjar) each with a mass of 10, 20, and 30 grams with a ratio of plants and solvents 1:10 as a biodetergent and phytoremediation agent.

CHAPTER II LITERATURE REVIEW

A. Detergent

Detergent is a cleaning tool used to clean clothes and household items. The main components of detergents are surfactants as foaming agents, bleaches as chlorine releasing agents, stabilizers, building substances (phosphates, zeolites, polycarboxylic acids, ect.), and perfumes. In addition, there are alo components of enzymes, dyes, bactericides, and other ingredients (Tiwari, 2013). There are several types of surfactants that have been developed to form detergent formulations.

B. Binahong

Binahong tree (*Anredera cordifolia*) is commonly found and recently known in Indonesia as a herbal medicine. Although in China this plant is called *Dheng San Chi* and has been an important medicine among healers for a long time. While in Vietnam and Taiwan, binahong is popular as a mandatory dish (Mardiana, 2012). Binahong tree is known as a medicine tree because it contains herbs. Although known as a herbal plant, binahong is a disturbing weed and is even considered a hazard in some countries, such as Australia, America, New Zealand, and South Africa (Weng and Shen, 2021). Binahong contains saponins which are known as ingredients in the manufacture of natural detergents, this content is rich in the leaves of the binahong tree. The flavonoid content in the binahong tree is known as an antioxidant and has the potential as a phytoremediation agent (Mardiana, 2012). Flavonoids themselves are ingredients from plants that can be used for phytoremediation, this is in accordance with research conducted by Khoiriah et al which proved that flavonoids and tannins in *P. oleraceain* plants (Khoiriah et al, 2019).

Picture 1. Binahong Leaves
Source: https://www.halodoc.com/artikel/5-manfaat-daun-binahong-untuk-kecantikan

C. Mustard Green

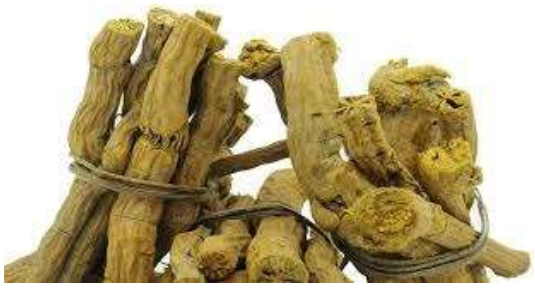
Mustard green (*Brassica juncea*) is a plant that is easy to find and commonly consumed by the public. Mustard greens belong to the *Brassiceceae family* which have potential as phytoremediation agents (Agwaramgbo *et al.*, 2012). Green mustard was chosen as a phytoremediation agent, especially in heavy metals and pesticides (Oulad El Majdoub *et al.*, 2020). Heavy metals that can be tolerated and accumulated, even hyperaccumulation by mustard greens are cadmium (Cd), selen (Se), nickel (Ni), lead (Pb), and zinc (Zn), as shown by strong evidence from plants. Itself, according to research conducted by Agwaramgbo et al, name the reaction of mustard greens to ead (Pb) with positive results in the form of decreasing lead levels

Picture 2. Mustard Greens
Source: https://shopee.co.id/Sawi-Hijau-Segar-250gr-1Kg-Caisim-Segar-i.11582976.8935835057

(control) up to 98% (Agwaramgbo *et al.*, 2012).

D. Yellow Root

Yellow root plant (*Fibraurea chloroleuca Miers*) is also used as herbal medicine. Based on the distribution areas, yellow root was spread in Malaysia, Brunei, the Philippines, Sumatra, Java, North-East Kalimantan, and Sulawesi. Therefore, the circulation of the famous yellow root is found in Kalimantan. The Dayak people often use it as a medicine for stomach aches, eye drops, jaundice, cancer sores, and intestinal worms. Yellow roots are also found in Ambon, where local residents used it as a plaster for smallpox. Yellow root itself contains alkaloids, tannins, saponins that can be used as natural detergents, and flavonoids which are known to have the potential to carry out phytoremediation (Darma and Marpaung, 2020).



Picture 3. Yellow Roots
Source: https://faseberita.id/lifestyle/sudah-dipatenkan-akar-kuning-bisa-cegah-kanker-hati

E. Phytoremediation

There are various phytoremediation techniques, namely phytodegredation, phytoextraction, phytofiltration, phytostabilization, phytovolatilization, rhizodegradation, and phyto desalination. Phytodegradation is able to do in green leafy vegetable plants (Ali, Khan and Sajad, 2013). In phytodegradation, plants take up the contaminants and break it down to simpler less toxic forms. The factors affecting the phytodegradation include pollutants uptake efficiency which are its concentration in the soil and the water present in the ground. *Brassica juncea* is one of the plants that have the greatest phytoremediation qualities, according to new biotechnology research that is focused on genetically modified plants (Muthusaravanan *et al.*, 2018).

CHAPTER III RESEARCH METHOD

A. Research Time and Place

This research was conducted on November 9th 2021 to March 17th 2022. The research was carried out in Depok and Central Jakarta.

B. Research Method

In making this biodetergent, the experimental methods that were used through the following steps:

1. The preparation stage, covering problems, collecting references from various sources, and preparing the tools and materials needed.

2. Make extracts of binahong leaves, mustard greens, and yellow roots with the mass of 10, 20, 30 grams also the mixtures (Binjar) with the mass of 10, 20, and 30 grams.
3. Perform high & foam stability test, pH, organoleptic, detergency test, and phytoremediation test
4. Do the paperwork.

C. Tools and Materials

1. Tools

a. Tools for making binahong leaf, mustard greens, and yellow roots extracts.
   1) Digital scale with an accuracy of 0.01
   2) Scissors
   3) Dryer machine (oven)
   4) Tightly closed container
   5) Blender
   6) Beaker glass 100 mL and 500 mL
   7) Measuring cylinder 50 mL and 500 mL
   8) Funnel
   9) Stirrer
   10) Spiritus

b. Tools for foam stability test
   1) Measuring cylinder 250 mL
   2) Measuring cylinder 500 mL
   3) Ruler
   4) Plastic
   5) Rubber bands
   6) Stopwatch

c. Tools for pH test
   1) pH meter
   2) pH paper

d. Tools for detergency test
   1) Bucket
   2) Towel

e. Tools for phytoremediation test
   1) Water test strip 14 in 1

2. Materials

a. Ingredients for making binahong leaf, mustard greens, and yellow roots extracts and plants mixtures (Binjar)
   1) Binahong leaves
   2) Mustard greens
   3) Yellow roots
   4) Aquadest

b. Material for foam stability test
   1) Binahong leaf, mustard greens, and yellow roots extracts
   2) Plant mixtures (Binjar)

c. Materials for pH test
   1) Plant mixtures (Binjar)
   2) Aquadest
   3) Buffer solution

d. Materials for detergency test
   1) Hot sauce
   2) Cooking oil

3) Water
4) Plant extracts (Binahong leaf extracts, yellow roots extracts, and Binjar)

e. Materials for phytoremediation test
1) Plant mixtures (Binjar)
2) Wastewater (sewage and Ciliwung River water)

D. How to Make Plant Extract

Binahong leaves and mustard greens were weighed with a mass of 700 g, and yellow roots were weighed with a mass of 300 g using a digital scale. Then, binahong leaves, mustard greens, and yellow roots are washed thoroughly with water. Next, the plants are cut using scissors or a knife. After being cut, binahong leaves, mustard greens, and yellow roots are dried in an oven at 200 degrees celsius for 15 minutes. In order to obtain the powder, binahong leaves, mustard greens, and yellow roots were ground using a blender. Then, the plant's powders are stored in a dry container, tightly closed, and protected from the sunlight. Binahong leaves, mustard greens, and yellow roots that have been mashed and then weighed with different masses, namely :

- Binahong leaves (B.L): B.L1 as much as 10 grams, B.L2as much as 20 grams, B.L as much as 30 grams = total 60 grams of binahong leaves.
- Mustard greens (M.G): M.G1 as much as 10 grams, M.G2 as much as 20 grams, M.G3 as much as 30 grams = total 60 grams of mustard greens.
- Yellow roots (Y.R): Y.R1 as much as 10 grams, Y.R2 as much as 20 grams, Y.R3 as much as 30 grams = total 60 grams of yellow roots.

Each 10, 20, 30 grams of powdered binahong leaves, mustard greens, and yellow roots were dissolved in 100, 200, 300 mL of distilled water in a beaker glass, then heated with a spiritus for 5 minutes respectively, then placed in measuring cylinders. Last but not least, mix every aquos for each gram; 10 grams of plant mixture (Binjar) for 100 mL, 20 grams of plant mixture (Binjar) for 200 mL, and 30 grams of plant mixture (Binjar) for 300 mL.

E. How to Test

1. Foam Stability Test.

Put each extract into a measuring cylinder. There will be two steps. First, the cylinders were for 10 minutes; Second, the foam heights were measured by a ruler every 5 minutes for 30 minutes.

2. pH Rate Test.

There will be only one step, which is to measure each extract with pH paper (universal indicator) and pH meter.

3. Organoleptic Test.

In order to do the test, it will need an observation on the color and smell of each sample.

4. Detergency Test

There will be four steps to accomplish this test. First, the oil and hot sauce (stains) were applied on the cloth, then waited for an hour; Second, after the stains were absorbed, the stained parts were rubbed 10 times using water as the control and extracts as the variables; Third, the clothes were rinsed with clean water.

5. Phytoremediation Test

In this test, there will be three big steps. First, the washed water were mixed with 200 mL and 300 mL of Ciliwung River water and the sewer water each into 4 different bottles and incubate them for 15 hours; Second, the detergent water were mixed with 200 ml each of Ciliwung River water and sewer water into 2 bottles and incubate them for 15 hours (control); Third, the water strip tests were inserted into all samples and record the data in a table.

CHAPTER IV RESULTS AND DISCUSSION

A. Height and Foam Stability Test

Foam stability can be measured based on its height using a ruler for every 5 minutes from 30 minutes.

Time	Extract of plants 10 grams			
	Binahong	**Mustard greens**	**Yellow roots**	**Binjar 10**
5 minutes	4 cm	3 cm	7,5 cm	5 cm
10 minutes	0,5 cm	0,1 cm	4,5 cm	0,5 cm
15 minutes	0,5 cm	0 cm	2 cm	0,3 cm
20 minutes	0,2 cm	0 cm	0 cm	0,2 cm
25 minutes	0,1 cm	0 cm	0 cm	0,1 cm
30 minutes	0 cm	0 cm	0 cm	0 cm
Average	5,3 cm	0,52 cm	2,3 cm	1,02 cm
Time	**Extract of plants 20 grams**			
	Binahong	**Mustard greens**	**Yellow roots**	**Binjar 20**
5 minutes	4 cm	4,5 cm	8 cm	7 cm
10 minutes	2 cm	1 cm	6 cm	5 cm
15 minutes	1 cm	1 cm	5 cm	5 cm
20 minutes	1 cm	1 cm	5 cm	3,5 cm
25 minutes	0,5 cm	1 cm	4,5 cm	3 cm
30 minutes	0,5 cm	1 cm	4,5 cm	2 cm
Average	4,5 cm	1,58 cm	5,5 cm	4,25 cm

Time	Extract of plants 10 grams			
	Binahong	**Mustard greens**	**Yellow roots**	**Binjar 10**
Time	**Extract of plants 30 grams**			
	Binahong	**Mustard green**	**Yellow roots**	**Binjar 30**
5 minutes	5 cm	4 cm	7 cm	8 cm
10 minutes	1 cm	1 cm	6 cm	7 cm
15 minutes	1 cm	1 cm	5 cm	6,5 cm
20 minutes	1 cm	1 cm	4,5 cm	5 cm
25 minutes	0,8 cm	1 cm	4,5 cm	4,5 cm
30 minutes	0,5 cm	1 cm	4,5 cm	4,5 cm
Average	9,3 cm	1,5 cm	5,25 cm	5,91 cm

According to the table above, binahong leaves extracts 10, 20 and 30 grams have good foam heights due to its saponin component. In the elder leaf, it can reach 2,36 ig/mg, in which that part has the highest saponin component among the other parts. The table also shows that every mass of yellow root extract has a passable height with satisfying average for 20 grams and 30 grams, it is caused by its high saponin content in the plant to the amount of 4,51% (Darma and Marpaung, 2020). Meanwhile, for mustard green, it showed that each extract does not have a good foam stability due to its low saponin contents. For Binjar 30 (binahong leaf, mustard green, and yellow root mixture extract for 30 grams) each has excellent height and foam stability among the three extracts. This is due to more dissolved (plant extract) and solvent (aquadest) added. Using an equation, Binjar 30has a high percentage which is 56,25%.

B. pH Test

The pH rate of each leaf extract is measured using a pH meter for every 5 minutes from 30 minutes. The pH test on each 30 grams of leaf extracts and Binjar is in the table below.

Time	Extract of plants 10 grams			
	Binahong	**Mustard green**	**Yellow root**	**Binjar 10**
5 minutes	6	5,63	5,5	5,95

10 minutes	6	5,63	5,5	5,95
15 minutes	6	5,63	5,5	5,95
20 minutes	6	5,63	5,5	5,95
25 minutes	6	5,63	5,5	5,95
30 minutes	6	5,63	5,5	5,95
Average	6	5,63	5,5	5,95
Time	**Extract of plants 20 grams**			
	Binahong	**Mustard green**	**Yellow root**	**Binjar 20**
5 minutes	5,8	5,84	5,7	6
10 minutes	5,8	5,84	5,7	6
15 minutes	5,8	5,84	5,7	6
20 minutes	5,8	5,84	5,7	6
25 minutes	5,8	5,84	5,7	6
30 minutes	5,8	5,84	5,7	6
Average	5,8	5,84	5,7	6
Time	**Extract of plants 30 grams**			
	Binahong	**Mustard green**	**Yellow roots**	**Binjar 30**
5 minutes	5,98	5,85	5,74	6
10 minutes	5,98	5,85	5,74	6
15 minutes	5,98	5,85	5,74	6
20 minutes	5,98	5,85	5,74	6
25 minutes	5,98	5,85	5,74	6

30 minutes	5,98	5,85	5,74	6
Average	5,98	5,85	5,74	6

According to the water quality standard, the safety pH rate on humans and the environment is 6-9. It is suitable with its pH that verges to 6, which means the pH is environmentally safe.

Furthermore, the pH rates are not influenced by time differential, proven with nothing changed for 30 minutes in every extract.

C. Organoleptic Test

Organoleptics testing is done by observing the color and smell of the plant extract. The organoleptics test on each 10, 20 and 30 grams of leaf extracts and Binjar is in the table below.

Parameters	**Extract of plants 10 grams**			
	Binahong	**Mustard green**	**Yellow roots**	**Binjar 10**
Smell	plant like	seaweed	coffee	plant like
Color	brownish green	green	brown	brown
	Extract of plants 20 grams			
Smell	plant like	seaweed	coffee	plant like
Colors	brownish green	green	brown	brown
	Extract of plants 30 grams			
Smell	plant like	seaweed	coffee	plant like
Colors	brownish green	green	brown	brown

D. Detergency Test

The detergency test is done only on extracts of binahong leaves, yellow roots, Binjar 30 mixture and water (control) and not on mustard greens. Due to the lack of saponin in mustard green proven by its foam height and stability, hence mustard green is used for the phytoremediation agent.

Control	**Extract of plants 30 grams**

Water	Binahong	Yellow root	Binjar 30
			

The best result was obtained from binahong leaf extract. Sauce and oil stains were gone, followed by the smell, and the fabric's color almost stayed the same. Even though the color was not as good as water, binahong leaf extract gave a satisfactory outcome. The result for 30 grams of yellow root extract was good enough. Stains and smells were gone, yet the color of the fabric looked yellow due to the pigment in the extract. The result of Binjar 30 is excellent. Both sauce and oil stains were gone, no more smell, and the fabric's color almost remained the same. Although the color of fabric that was washed using Binjar 30 is not as good as water, Binjar 30 served better results on detergency and stains removal. Binahong leaf extract has the ability to maintain the fabric's original color well. On the other hand, yellow roots can be a decent bio detergent agent and foam stability. While mustard green is capable of being a proper phytoremediation agent, based on the testing results. Hence, mixing the three plants brings out not just cleansing the stains, but also maintaining the fabric's origin color, and doing phytoremediation.

E. Phytoremediation Test

Water quality standard class III and IV are used as the standard due to the two of them having the same allocation. Since fluoride and nitrite water quality standards can not be measured with only class IV, therefore, it is also necessary to use class III in order to know fluoride and nitrite water quality standards.

No	Indicator (mg/L)	Detergent (Without Treatment)		Binjar-20 (With 20 grams of each plants mixture)		Binjar-30 (With 30 grams of each plant mixture)	
		Sewer water	Ciliwung River water	Sewer water	Ciliwung River water	Sewer water	Ciliwung River water
1.	Lead (Pb)	1,64	1,64	0,16	0,16	0,16	0,16
2.	Copper (Cu)	0,003	0,003	0	0	0	0
3.	Iron (Fe)	0,016 to 0,03	0,016 to 0,03	0	0	0 to 0,016	0 to 0,016
4.	Chromium (Cr)	0,007	0,007	0,007	0,007	0,006	0,006

5.	**Sulfate**	0,03	0,03	0	0	0	0
6.	**Free Chlorine (Cl)**	0,003	0,003	0,03	0,03	0,006	0
7.	**Bromine (Br)**	0,014	0,014	0,003	0,03	0,003	0,003
8.	**Nitrate**	0,16	0,16	0,16	0,16	0,16	0,16
9.	**Nitrite**	0,016 to 0,065	0,016 to 0,065	0,003 to 0,014	0,016 to 0,03	0 to 0,003	0,016 to 0,03
10.	**Mercury (Hg)**	0	0	0	0	0	0
11.	**Fluoride**	0,16	0,16	0,328	0,16	0,33	0,16
12.	**Hardness**	0,08	0,08	0,4	0,4	0,16	0,16
13.	**pH**	9	9	7	7	6	7
14.	**Alkalinity**	0,46	0,46	0,42	0,39	0,13	0,16

*****all the results were divided by 305

Water Quality Standard Class III and IV (water for fish cultivation, irrigation, etc that needs water's terms) on chemistry

No.	**Parameter**	Unit	Quantity
1.	pH		5-9
2.	Chromium (Cr)	mg/L	1
3.	Copper (Cu)	mg/L	0,2
4.	Iron (Fe)	mg/L	-
5.	Lead (Pb)	mg/L	1
6.	Mercury (Hg)	mg/L	0,0005
7.	Fluoride	mg/L	1,5
8.	Nitrite	mg/L	0,06
9.	Nitrate	mg/L	-
10.	Free Chlorine	mg/L	0,03

*Class III and class IV are used as the standard due to the two of them having the same allocation. Since fluoride and nitrite water quality standards can not be measured

with only class IV, therefore, it is also necessary to use class III in order to know fluoride and nitrite water quality standards.

The results of both plant mixtures (Binjar 20 and Binjar 30) are good. It is shown from indicator water strip test 14 in 1 table above and the water quality standard class III according to PP No. 82 on 14th December 2001 (National Law). Iron (Fe) and sulfate only have water quality standard class I, which would lead to a conclusion that Binjar 20 and Binjar 30 have chemical rate that fulfills the terms. With hardness in the interval between 0-75 mg/L, both Binjars have tender hardnesses, which means having low CaCO3. While the alkalinity indicator is suited to the terms on alkalinity rate for the environment including fish, which is 20 mg/L (Permata, 2018). Also, both detergent, Binjar 20, and Binjar 30 do not influence any increasing Mercury (Hg). Nevertheless, detergent mixture with sewer water and Ciliwung River's water have high Lead (Pb) and nitrite rates above the water quality standard.

CONCLUSION AND SUGGESTIONS

A. Conclusion

1. Binahong leaf has saponin content that can be used on foam making and serving good results on detergency. Other than that, binahong leaf's pH is approximately to water quality standards.
2. Mustard green contains a flavonoid compound that has a role as a phytoremediation agent towards heavy metals.
3. Yellow root has saponin contents in order to make foams. Besides, compared to others, yellow roots produce the highest and the most stable foams.
4. On Binjar-30, binahong leaf and yellow root become detergency agent while mustard green as phytoremediation agent. Furthermore, just like binahong leaf extracts, Binjar-30 also produced excellent detergency.
5. The research has reached the purpose of the study.

B. Research Benefits

1. Provide an alternative to the use of biodetergents that are environmentally friendly.
2. Make use of abundant materials.
3. Help prevent water pollution by using phytoremediation agents that are environmentally friendly and easy to find.
4. Improve critical and innovative thinking skills.

C. Suggestions

1. Further research will be needed in order to accomplish fabric's origin colors after being washed with "Binjar".

2. Further experiments will be needed in order to neutralize Binjar's color using chloroform and NaOH 2%. The detergent is now still under development..
3. Further studies will be needed in order to realize a perfect "Binjar".
4. Socialization of "Binjar" as a biodetergent to the public will be needed in order to reduce the usage of detergent so that it can prevent water pollution.

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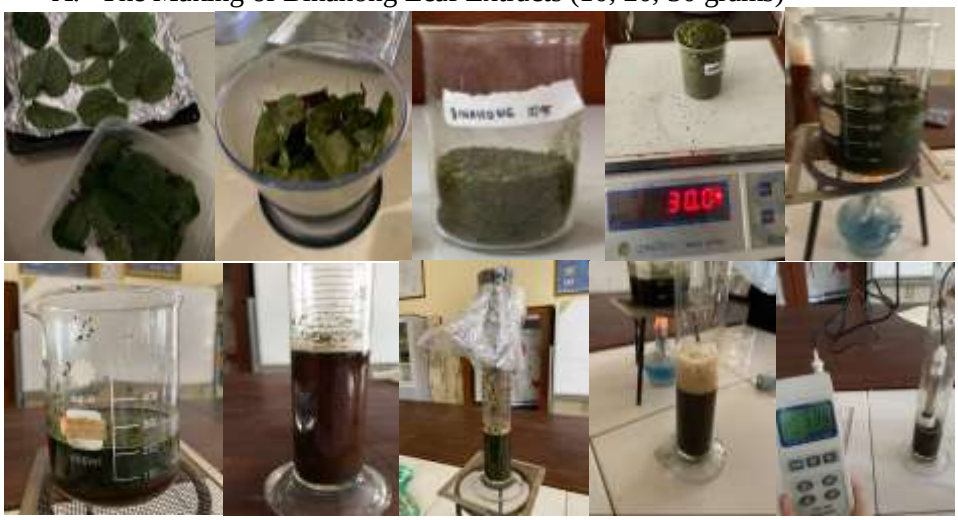
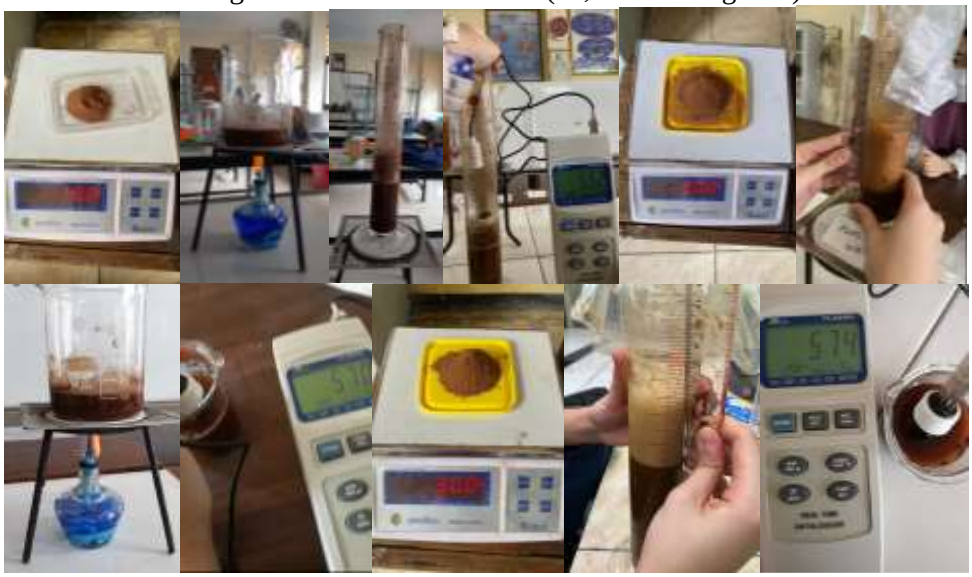
ATTACHMENTS

A. The Making of Binahong Leaf Extracts (10, 20, 30 grams)



B. The Making of Mustard Green Extracts (10, 20 and 30 grams)

C. The Making of Yellow Root Extracts (10, 20 and 30 grams)



D. The Making of Binjar (10, 20 and 30 grams)

E. The Process of Detergency Test

F. The Process of Phytoremediation Test