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The effectiveness of the use of *Moringa oleifera* and *Eichornia crassipes* activated coagulant seeds in the process of canal waste water cleaning in Makassar

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ABSTRACT

The processing of natural coagulant materials into something that can provide a wider benefit and a greater contribution to society. This study aims to determine the combination of coagulants that are effective in reducing pH and turbidity in domestic wastewater. This research begins with taking *Moringa oleifera* and *Eichornia crassipes*, making coagulants from these two materials, then taking the wastewater after that prepare a stirrer, the two coagulants are put in a beaker glass then the solution is stirred at 180 rpm for 2 minutes using a mixer, then stirring again at 40 rpm for 15 minutes. The solution is allowed to stand for 20 minutes until 2 layers are formed, after which the filtrate and sediment are separated with filter paper (filter membrane) then turbidity and pH measurements are carried out. The effectiveness of each treatment using the percentage change (% change). The results obtained were for the largest decrease in pH was found in *Moringa oleifera* of 6.880 then followed by combination 1 and combination 4. As for Turbidity, the increase occurred in the treatment of combination 2 to combination 6, and the decrease in turbidity in the treatment of *Eichornia crassipes*, combination 1, and *Moringa oleifera*, namely 1,050 NTU; 1,120 NTU and 1,760 NTU. The conclusion is the effectiveness of the combination of coagulants between *Moringa oleifera* and *Eichhornia crassipes* for pH and Turbidity is a combination of 1 (10 + 10) mg.

Key words : *Moringa oleifera, Eichornia crassipes, Coagulant, Wastewater*

Introduction

The public generally does not care about the cleanliness of canals, rivers, and other water bodies, so a cheap and easy technology for domestic wastewater control is needed. The results of this study are expected to provide solutions to them on how to use natural materials to obtain clean water from domestic wastewater before use. One of the steps that can be taken is to precipitate the impurities contained in it by using natural collectors such as moringa seeds (Haslinah, 2012).

Coagulation is the clumping of colloidal particles due to the merging of charged colloid particles to form larger particles. Coagulants are substances that cause coagulation. Some examples of coagulants are chitin/chitosan, resin, moringa seeds (*Moringa oleifera*), activated water hyacinth (*Eichhornia*

crassipes), and activated Azolla (Nursyamsi *et al.*, 2011). Meanwhile, according to (Haslinah *et al.*, 2015), that the optimum condition of the *Eichhornia crassipes* coagulant which can reduce the heavy metals Lead and cadmium is the addition of 70 mg for Lead metal and 40 mg for cadmium metal, while the percent reduction in heavy metals Lead and cadmium with the highest *Eichhornia crassipes* coagulant or greater in channel wastewater The Makassar Terong Market is located at point II at 63.06% for Lead metal and 46.99% for Cadmium metal.

According to (Haslinah, 2012), The results showed that the moringa seed coagulant was able to bind the dissolved solid particles faster than Al2 (SO_4) 3.18H2O at 30 minutes while Al2 (SO_4) 3.18H2O only at 50 minutes. For moringa seed coagulants, clear fluid areas occurred within 30 minutes. This is because moringa seeds contain the active substance rhamnosyloxybenzil isothiocyanate which is able to adapt and neutralize sludge and metal particles contained in suspended wastewater.

Chemical coagulants are commonly used in domestic waste treatment. As public awareness about the environment increases, the use of coagulants that are more environmentally friendly is starting to be widely used and continues to be researched. One of the coagulants is from the seeds of *Moringa oleifera* and *Eichhornia crassipe*s. The purpose of this study was to test the effectiveness of the coagulant *Moringa Oleifera* and *Eichhornia crassipes* in the process of purifying canal wastewater.

Research Methods

This research is an experimental laboratory conducted at the Traya Tirta Makassar Laboratory. The main ingredient used is *Eichhornia crassipes* in the Batuaraya canal which is then made into powder as well as for moringa seeds. Makassar Market Canal wastewater sample. Laboratory analysis carried out at the Laboratory of the Class I Environmental Health Engineering Center in Makassar.

The main tool used is the Flocculator jar test. Supporting tools used are: glass beaker, measuring flask, funnel, stirrer, measuring cup, analytical balance (Ohaus explorer ex224 version 1.10/1.10 balance), oven, blender, and 70 mesh sieve filter.

Treatment of *Moringa oleifera*

To make moringa seed coagulant, moringa fruit that is ripe (brown in color) and naturally dry on the tree is taken and the seeds are removed from the fruit. Clean seeds are blended into powder and sieved with a 70 mesh sieve, then stored in a container at room temperature (28 – 30 °C).

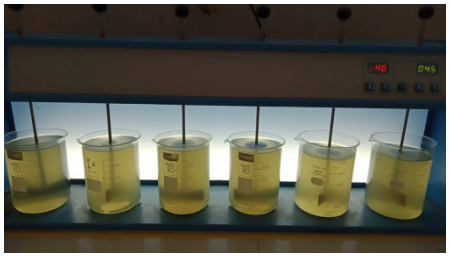

Fig. 1. Jar Test Tool Chain

70 mesh size Moringa seeds are dried in an oven at 105 °C for 30 minutes to homogenize the moisture content. The *Moringa* seed powder is then put in a container and then mixed with the aquadest (1g of Moringa seed powder in 20 ml of aquadest). This solution is then used as a coagulant.

Treatment of *Eichornia crassipes*

Before use, the *Eichhornia crassipes* plant is activated with an acid solution or *Eichhornia crassipes* powder soaked with 0.1 M HNO_3 for 8 hours then washed with aquadest repeatedly while filtered until the washing water reaches neutral pH. After that, the *Eichhornia crassipes* powder was filtered and dried in an oven at a temperature of 650 °C. Then the *Eichhornia crassipes* coagulant is obtained which is ready to use to reduce the wastewater content. Where the head of the researcher conducted sample processing.

Treatment of domestic waste using a combination of natural coagulants

For the *Eichornia crassipes* coagulant material by preparing a 1 L beaker, then adding the *Eichornia crassipes* coagulant with a mass of 10, 20, 30, 40, 50, and 60 mg. Then the solution is stirred at 180 rpm for 2 minutes using a mixer, then stirred again with the speed of 40 rpm for 15 minutes. The solution is allowed to stand for 20 minutes until 2 layers are formed, after which the filtrate and sediment are separated with filter paper (filter membrane) then pH and turbidity measurements are carried out. The same treatment for the *Moringa oleifera* coagulant material with mass variations of 10, 20, 30, 40, 50, and 60 mL. Processing and measurements were the same for the combination of the coagulant *Moringa oleifera* and *Eichhornia crassipes*.

The percentage change in the value of change in the concentration of several parameters of domestic wastewater quality

The equation used to calculate the value of processing efficiency is:

$$E = \frac{Co - Ci}{Co} \times 100\%$$

Where :

E : Percentage Change

Co : Concentration Before Processing

Ci : Concentration After Processing

Results and Discussion

Deegre of Acidity (pH)

The degree of acidity (pH) is very important as a parameter of water quality because pH controls the type and rate of velocity of some materials in the water. In addition, aquatic organisms can survive in a certain pH range. The pH fluctuation is largely determined by the alkalinity of the water. Water that is productive and supports the survival of aquatic organisms, especially fish according to PP No.82, which ranges from 6-9. The living conditions and living habits of fish are very tolerant of the acidity (pH) of the water.

Measuring pH is an absolute thing to do in wastewater treatment because wastewater treatment involves a biological process so that the role of pH is very important. The results of testing the pH parameters of domestic waste before and after processing can be seen in Table 1.

Table 1, showed that most of the treatments experienced a decrease in pH. The largest decrease in pH was found in *Moringa oleifera* of 6,880 then followed by a combination of 1 and a combination of 4. The pH value of wastewater before and after processing still meets water quality standards based on the regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number P.68 / Menlhk/Setjen. Kum.1 / 8/2016 concerning the quality standard of domestic wastewater (6.0-9.0).

Most of the aquatic biota is sensitive to changes in pH and likes a pH value ranging from 7-8.5. The pH value greatly affects the biochemical processes of the waters, for example, the nitrification process will end if the pH is low. It shows that the pH value of treated water produced from Moringa kernel powder is lower (7.24) compared to Moringa kernel pulp powder (7.40). The pH value of treated water

Table 1. The results of testing the pH parameters of domestic waste before and after processing

Treatment	pH	
	Before Processing	After Processing
Eichhornia crassipes Activation	7.14	7.027
Moringa oleifera	7.14	6.880
Combination 1	7.14	6.980
Combination 2	7.14	7.007
Combination 3	7.14	7.023
Combination 4	7.14	6.983
Combination 5	7.14	7.003
Combination 6	7.14	7.000
Quality Standards	6-9	

resulted from the three concentrations of moringa kernel powder and moringa kernel dregs powder tended to change but was still above the pH value of river water before processing. This indicates that moringa kernel powder and moringa kernel dregs powder can reduce water acidity and do not decrease the pH value of water during coagulation (Irmayanti *et al.*, 2019).

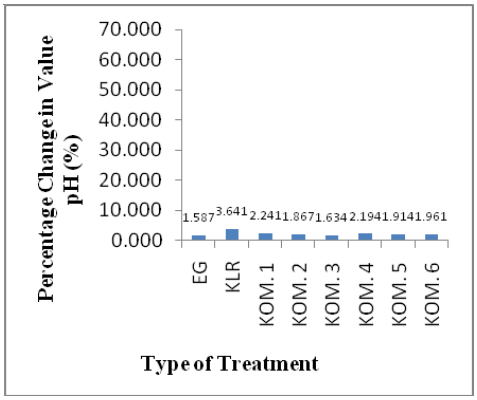

Fig. 1. Graph of the percentage change in the mean pH value

The level of acidity (pH) can affect the solubility of a coagulant. The easier the coagulant dissolves, the easier it is to form aquometallic ions, which in turn, the faster the colloid particles are neutralized to form floc. The greater the pH, the smaller the solubility of the coagulant material, so that the aquametallic ion is more difficult to form, which ultimately reduces the number of colloid particles that can be neutralized to form a floc (Karamah and Septiyanto, 2008).

The results of measuring the percentage change in pH value during the study can be seen in Fig. 1.

Based on Figure 1 it shows that the pH value of wastewater during the study in most treatments has decreased. The highest decrease in pH value occurred in the processing treatment using *Moringa oleifera* at 3.641%, combination 1 and 4 followed by combination 6 and combination 5 at 1.914%. Meanwhile, the lowest percentage decrease in pH occurred in the combination treatment 2 and 3 and in *Eichhornia crassipes* by 1.587%.

According to Mi'rad *et al*., (2020), a decrease in pH for the combination of coagulant and flocculant alum + cation, it looks bigger. It is known that a significant decrease in pH occurs in the combination of coagulant and flocculant of alum + cation at a dose of 2%, the smallest decrease in pH is shown by the combination of coagulant and flocculant PAC + Anion at a dose of 0.5%. In the use of PAC as a coagulant, the pH of the treated water did not experience a sharp decrease in pH like the use of aluminum sulfate coagulants.

According to research (Nursyamsi *et al*., 2011), that the optimum growth for *Eichhornia crassipes* is shallow water, wide growing space, calm water, sufficient sunlight, temperature between 20-30 ^{o}C, sufficient nutrients, and a pH between 7.0-7.5, then *Eichornia crassipes* has good growth. better, but at a pH below 4.2 it can poison the growth of *Eichornia crassipes* to death.

Turbidity

Although water with high turbidity is easier to treat, it usually requires higher coagulant doses and produces more sludge. On the other hand, water with low turbidity will be difficult to coagulate because of the difficulty in contacting colloidal particles, so that little sludge is formed.

Turbidity is an optical effect that occurs when rays form suspended materials in water. Water turbidity can be caused by the presence of organic and inorganic materials such as mud and waste from certain surfaces which cause river water to become cloudy. Even a little turbidity can cause the color to be darker than the actual color. Water that contains high turbidity will have difficulty when processed for clean water sources (Quddus, 2014)

At a dose of 1000 mg/l with a pH value of 6, the turbidity decreased to 41.2 NTU. Starting from pH 6.0, the coagulation process began to occur well, enough floc was formed to reduce the turbidity value. This continued to pH 8.0 with a dose of 1250 mg/l, the turbidity value decreased to reach 14.42 NTU. This means that between pH 6.0 to pH 8.0 the collision process between particles occurs well. On the other hand, at pH 9.0, the turbidity increased again because the coagulant particles could no longer combine with the solid particles from the liquid waste. This occurs due to saturation of the attractive attractions between the particles (Novita *et al.,* 2014).

Table 2. Turbidity parameter test results of domestic waste before and after treatment

Treatment	Turbidity	
	Before Processing	After Processing
Eichornia crassipes Activation	1.310	1.050
Moringa oleifera	1.310	1.760
Combination 1	1.310	1.120
Combination 2	1.310	2.233
Combination 3	1.310	2.350
Combination 4	1.310	3.027
Combination 5	1.310	2.117
Combination 6	1.310	2.950
Quality Standards	25	

From Table 2, it can be seen that there is an increase in turbidity in almost all treatments, but the increase in turbidity is still within the threshold. The increase occurred in the treatment of combination 2 to combination 6, while the decrease in turbidity in the treatment of *Eichhornia crassipes*, combination 1, and *Moringa oleifera* were 1,050, 1,120 and 1,760, respectively. Determination of the optimum pH of the coagulation-flocculation process, the lowest turbidity value becomes the basis for selecting the optimum pH value of the waste.

According to (Huwae *et al*., 2018), It shows that gray water is not suitable at first, because it has a turbidity value of 68.00 NTU. After adding the moringa seed powder coagulant, the gray water is in a suitable range for reuse with average turbidity of 0.82 NTU in the addition of 2 gs of moringa seed powder, 3.07 NTU in an additional 3 grams, and 4.52 NTU in an additional 5 g. This shows that the use of moringa seed powder has been shown to significantly reduce the turbidity of gray water.

Figure 2 shows that the highest decrease in Turbidity value occurred in the treatment of *Eichhornia crassipes* and combination 1. While the lowest decrease in the value of Turbidity occurred in the *Moringa oleifera* treatment of -34,351% and succes-

sively combination 5, combination 2, combination 3, combination 6 and combination 4. This is because there is a repulsive force between the positively charged particles so that the floc deflocculation process occurs which results in the solution becoming increasingly cloudy (Coniwanti *et al.*, 2013)

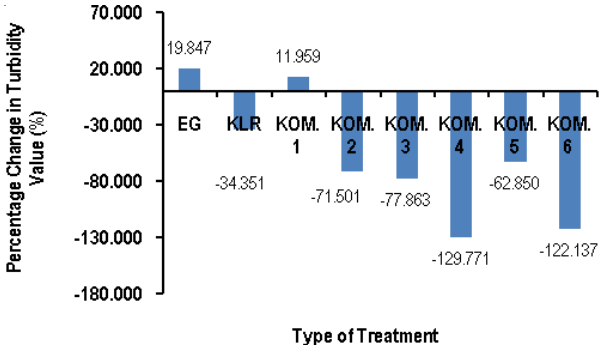

Fig. 2. Graph of the percentage change in the mean value of Turbidity

There was a difference between the use of the amount of coagulant *Moringa oleifera* (moringa seeds) and activated *Eichhornia crassipes*, wherein *Moringa oleifera* the increase in turbidity from a small mass to a large mass, on the other hand, in the number of *Eichhornia crassipes* coagulants there was a decrease in turbidity from a small mass to a large mass. greater than. This difference is due to the fact that in *Moringa oleifera* powder with a small amount of mass, the activity of the protein as a coagulant works optimally at that mass, while the mass of *Eichhornia crassipes* is activated due to the number and pores of the coagulant due to the increasing number or mass used the better the adsorption or absorption process. The reduction effectiveness was found in combination 1 (10 + 10 mg) of 11,959%.

Conclusion

The highest percentage reduction in pH value occurred in the processing treatment using Moringa oleifera at 3.641%, combination 1 and 4 followed by combination 6 and combination 5 at 1.914%. Meanwhile, the lowest percentage decrease in pH occurred in the combination treatment 2 and 3 and in *Eichhornia crassipes* by 1.587%. And the effectiveness of the highest reduction in Turbidity value occurred in the treatment of *Eichornia crassipes* and combination 1.While the increase in the value of Turbidity occurred in the *Moringa oleifera* treatment of -34.351% and consecutively combination 5, combination 2, combination 3, combination 6 and combination 4.

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