



The Use of Moringa Seed (*Moringa oleifera*) Extract as a Natural Coagulant to Reduce the Turbidity Level of Worongnge Village River Water

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ABSTRACT

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The quality of the water used by the community in Worongnge Village is poor water quality, therefore alternative solutions are needed to treat water so that the water is suitable for use. One process that can be used is the coagulation-flocculation process with Moringa seeds. The purpose of this study was to determine the concentration of Moringa seeds can stabilize the quality of water pH, TDS, and turbidity (turbidity) of river water in Worongnge Village. This research was conducted in the form of an experiment consisting of 5 treatments and each treatment used 1 liter of river water and each would be given 3 variations of time: (12 hours, 24 hours, 36 hours). The design is as follows: P0: 1 liter of river water without treatment P1: Provision of 1 liter of river water and 2 g of Moringa seed extract. P2: Giving 1 liter of river water and 4 grams of Moringa seed extract. P3: Giving 1 liter of river water and 6 grams of Moringa seed extract. P4: Giving 1 liter of river water and 8 grams of Moringa seed extract. The results of the research carried out found that the effective concentration of Moringa seed extract was 2gr(P1) where the results were water pH 7.2, water TDS 0.191, and turbidity (turbidity) 46. The use of Moringa oleifera seed extract as a natural coagulant is effective in reducing the turbidity of river water.

1. INTRODUCTION

Humans and all living things need water to meet their needs where all living things are never separated from water either to be used as a source of drinking water or for other purposes. Water is the material that makes life happen on earth. Plants and animals also need water so it can be said that water is a source of life [1] Therefore, the maintenance of quality and quantity is very important for a sustainable environmental sustainability.

The Ministry of Health of the Republic of Indonesia [2] stated that at normal tropical temperatures the human need (especially the adolescent and adult groups) for water is 2 liters or 8 glasses per day. This need for water is caused by the average content of the human body of 75% water and 25% The presence of solids, the average presence of water in the human body as much as 90% is in the blood, 75% is in the muscles, 22% is in the bones, and the liver contains two-thirds of water [3]. The ideal drinking water must have characteristics such as clear, colorless, tasteless, odorless, does not contain pathogenic germs and all living things that endanger human health, does not contain chemicals that can change body functions, does not leave deposits on the entire distribution network, non-corrosive and others. This aims to prevent the

occurrence and spread of waterborne diseases [4].

Rivers are one of the flowing natural resources, so that upstream utilization can reduce water quality, pollution and social costs for its preservation [5]. Rivers are also a source of water for the community which is used for various purposes and activities, such as household needs, agriculture, industry, mineral resources, and other uses. If these activities are not managed properly, they will have a negative impact on water resources, including decreasing air quality. This condition can cause disturbance, damage, and danger to living things that depend on water resources [6].

River water pollution is largely determined by the activities and benefits of water resources by humans in these waters. [7] defines water pollution as the entry or inclusion of living things, substances, energy and or other components into water by human activities, so that water quality drops to a certain level which causes water to not function according to its designation.

The turbidity of the water is said to be cloudy, if the water contains so many suspended particles of material that it gives a muddy and dirty color / appearance. Turbidity occurs basically due to the presence of colloidal substances, namely substances that float and decompose very finely. This is also due to the presence of finely decomposed organic matter,

micro-organisms, mud, clay, and similar colloidal substances or floating objects that do not settle immediately. Turbidity or degree of deformity is another and unique physical property of sewage and although its determination is not a measure of the amount of suspended matter, Turbidity is the number of suspended particles of matter in water. The higher the power of the scattered light, the higher the turbidity [8].

Based on direct observations made in Awakaluku Hamlet, Worongge Village, Sabbangparu District, Wajo Regency, people living on the river coast use river water as the main source of water for their daily needs, mainly as a source of drinkin [1], where the condition of the river water is still not suitable for use because river water The condition is cloudy and does not meet the criteria for water that is suitable for consumption. So that to meet the needs of the community for drinking water that is suitable for consumption, it is necessary to treat river water which can reduce the level of turbidity and harmful levels contained in the water [6].

Communities in riverbank areas often experience clean water crises due to high groundwater salinity. As an alternative to getting clean water, people generally use murky river water as a raw material, filtered using gravel and sand, but the result is not clear. The way to overcome this is to use appropriate technology in the form of water treatment with coagulation, filtration, absorption, ion exchange, phytoremediation, and microbial spray filtration with flue gas treatment equipment [9]. Liquid waste treatment includes filtration, adsorbs, biofilter, aeration and coagulation flocculation. One alternative treatment that can be done is flocculation coagulation. In the coagulation-flocculation process, it is necessary to add substances to help the process of deposition of suspended particles, namely coagulants, which are divided into 2, namely: chemical coagulants and natural coagulants [10].

The water treatment method, especially river water, which is commonly used is physico-chemical treatment, namely coagulation-flocculation followed by sedimentation. Wastewater flocculation can be used to increase the removal of BOD and suspended particles in the primary deposition unit, and can improve the performance of the unit secondary deposition after the activated sludge process which is one of the treatment introduction to the secondary effluent filtration process [11].

In the coagulation-flocculation process, alum is usually used as a coagulant and the use of alum as a coagulant is commonly used, but it is not effective enough to remove water color and reduce COD levels, the use of alum provides environmental losses because alum residue in wastewater discharged into the environment will react to the natural alkalinity of the water causing a decrease Phair environment [12]. The use of this method often fails because the process is too complex and requires relatively high costs. Several types of inorganic coagulants are widely used in water or wastewater treatment including aluminum sulfate $AL_2(SO_4)_3$ (alum), polyaluminium chloride $Al_n(OH)_mCl_{(3n-m)}$ (PAC), ferrous sulfate $FeSO_4(II)$, ferric chloride $FeCl_3(II)$, and others [1].

Local alternatives are also available, namely organic coagulants from plants that are easily obtained. Alternative coagulant, utilization of natural resources can generate alternative income economically. This natural coagulant is biodegradable and safe for human health [1]. One alternative in the water purification process is to use Moringa seeds as a natural coagulant. Because Moringa seeds have many benefits, one of which is a coagulant to reduce levels of liquid waste in

water [13]. Moringa seed coagulant (*Moringa oleifera*) has given advantages compared to other synthetic materials because it is natural and is reported to be consumed. The cost of using this natural coagulant will be cheaper than the use of commonly used coagulants (alum) for water purification [9]. In view of this, this research was conducted to see the ability of mature and dried Moringa oilseed extract as a coagulant to reduce the turbidity level of liquid waste [14]. The process of water purification with Moringa seeds can take place through physical (stirring and filtering) and biological (clumping or settling) processes and even absorption processes [15, 16].

Moringa seeds can be used as a natural coagulant because it has the active substance 4-alpha-4-rhamnosyloxy-benzylisothiocyanate which tends to be positively charged, so it is able to destabilize negatively charged colloids, such as PO_4^{3-} [12]. Moringa seed extract is a natural coagulation agent which is quite effective because Moringa seeds contain myrosine, emulsion, glyceric acid, polymeric acid, fats and oils as well as bactericidal substances [15, 17, 18]. Moringa seeds capable of absorbing and neutralizing mud particles and metals that contained in the waste so it is very potential to be used as a natural coagulant to clean the water so that it is drinkable. In addition, Moringa seeds contain oil with levels of $\pm 38\%$ and in oil each contains vitamin E and betacarotene by 0.01%. Seeds that old contain carbohydrates, methionine, cysteine, benzyl glucosinolate, moringin, monopalmitate [19].

The part of Moringa (*Moringa oleifera*) seeds that acts as a flocculent is a water-soluble protein. Although not all proteins can not act as flocculants. Moringa seeds contain protein, carbohydrates and fats that act as flocculants. Soluble proteins that dissolve in water will produce water soluble which is positively charged. The solution has the properties of alum polyelectrolytes. Alum polyelectrolytes are polymers that can bind colloidal particles and form precipitating flocs. The binding ability of Moringa seeds with impurities, be it mud or metal, all depends on the active substance of rhamnosyloxy benzilisoithiocyanate which can absorb and neutralize mud and metal particles [20].

The protein content in Moringa (*Moringa oleifera*) seeds is cationic polyelectrolyte which is a natural coagulant that can improve water quality [21-23]. From the description above, the use of natural coagulant materials such as moringa seeds can replace synthetic coagulants such as alum so that the problems faced by society and industry can be resolved. On the other hand, the utilization of Moringa seeds which have been rarely used will certainly help improve the economy of farmers who plant Moringa trees. Based on research the protein which is a cationic polyelectronic in Moringa seeds acts as a coagulant of the particles cause of turbidity. Proteins are made up of hundreds of amino acids linked together each other to form peptide bonds and determine the nature of the protein. Amino acid in a neutral solution, it always forms a dipole ion or also called a zwitter ion [24].

The effectiveness of Moringa seed bioflocculants in the pulp and paper industry wastewater treatment process has been carried out. Parameters that observed were color, deposition time, turbidity, Total Suspended Solid (TSS), Chemical Oxygen Demand (BOD), and Biological Oxygen Demand (COD). Results his research showed that moringa seed bioflocculants at a concentration of 1500 ppm able to precipitate flocs of pulp and paper industry liquid waste within 8 minutes 20 seconds, the effectiveness of the color value is 69.79%, the turbidity value is 91.47%, TSS 18.45%, COD 75%, and BOD 81.49%. For PAC (Poly Aluminum Chloride),

when compared to Moringa seed biofloculants gave no different parameters of turbidity and COD values real, but in terms of the time parameter of moringa seed deposition, it gives good results better. In the color value and BOD parameters, it turns out that PAC gives good results better than Moringa seed biofloculants, this means that Moringa seeds can useful as a biofloculant in the pulp and paper industry wastewater treatment process paper [25].

2. MATERIALS AND METHODS

2.1 Research type and design

The research design used was a Randomized Block Design (RAK), with 5 treatments and 3 replications where each treatment used 5 water samples, each 1 liter of water with a concentration of 2gr, 4gr, 6gr, and 8gr and 3 time variations.

2.2 Research time and place

This research was carried out in Awakaluku Hamlet, Worongnge Village, Sabbangparu District, Wajo Regency from March to May 2022.

2.3 Research design

This research was conducted in the form of an experiment consisting of 5 treatments and each treatment used 1 liter of river water and each will be given 3 variations of time: (12 hours, 24 hours, 36 hours).

The plan is as follows:

P0: 1 liter of river water without treatment

P1: Giving 1 liter of river water and 2gr of Moringa seed extract.

P2: Giving 1 liter of river water and 4 gr of Moringa seed extract.

P3: Giving 1 liter of river water and 6gr of Moringa seed extract.

P4: Giving 1 liter of river water and 8gr of Moringa seed extract.

12 hour	24 hour	36 hour
P0	P0	P0
P1	P1	P1
P2	P2	P2
P3	P3	P3
P4	P4	P4

3. RESULTS AND DISCUSSION

3.1 Water pH measurement

Data on the results of measuring the pH of the river water in Worongnge Village can be seen in the following Table 1.

Based on the observations made, it was shown that the P1 treatment showed a significant decrease in water pH, from pH 8.2 to pH 7.2. Compared to the P0 treatment, the pH level of the water did not change, namely pH 8.4 to pH 8.5.

Table 1. Water pH measurement

Treatment	Time Variation			Average
	12 hour	24 hour	36 hour	
P0	8.4 pH	8.5 pH	8.5 pH	8.7
P1	8.2 pH	7.4 pH	7.2 pH	7.6
P2	7.9 pH	6.5 pH	6.5 pH	6.7
P3	7.9 pH	6.5 pH	6.4 pH	6.9
P4	7.9 pH	6.3 pH	6.4 pH	6.8

Table 2. Anova test water pH measurement

Variance	Degree of freedom	Number of square	Middle square	F-count	F-table	
					0.05	0.01
Treatment	4	209,090833	52.23	106,96	3.50	6
Fallibility	10	4,88666667	0.47			
Total	14	213,9775				

Based on Table 2 the ANOVA test using a 5% confidence value shows that F count 106.96 > F Table 6, it can be said that the treatment has a significant effect on decreasing pH levels where at the concentration of P1 treatment 1 (12 hours) the pH of the water is 8, 4 there was a decrease in treatment 2 (24 hours) the pH of the water became 7.4 and there was a decrease again in treatment 3 (36 hours) to pH of 7.2 water based on the results obtained, then continued with the BNJ test (Honest Significant Difference).

Table 3. Average water pH measurement

Treatment	Average	BNJ
P0	8.5	
P1	7.6	
P2	6.9	1.87
P3	7	
P4	6.8	

Based on the BNJ test values in Table 3 at a 5% confidence level, it can be seen that the P0 treatment with an average value of 8.5 was not significantly different from the P1, P2, P3 and

P4 treatments which can be seen in Figure 1.

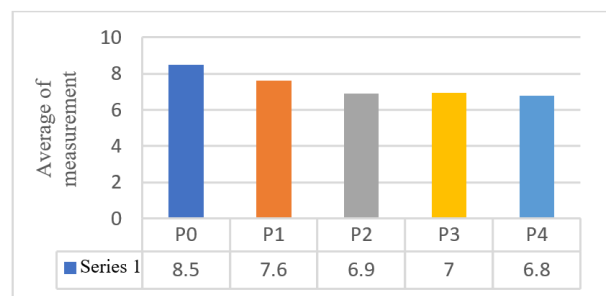


Figure 1. Average of water pH measurement

The results of data analysis testing the pH of river water with the addition of Moringa seed extract, namely in experiments carried out without using Moringa seed extract, namely P0 in the first repetition (12 hours) the pH of the water was at 8.4 and after the second (24 hours) and third repetitions (36 hours) the pH of the water is at 8.5, this explains that the water that has been allowed to sit does not decrease in pH to

the normal pH of suitable water.

In the second time variation (12 hours) with P1, P2, P3, P4 treatment given each dose of 2gr,4gr,6gr and 8gr there was a decrease in PH water levels, namely P1 = 7.9, P2 = 7.6, P3 = 7.6, P4= 7.2. In the first time variation (24 hours) with treatment P1, P2, P3, P4 given each dose of 2gr, 4gr, 6gr and 8gr there was a decrease in the pH level of the water, namely P1 = 7.4, P2 = 6.5, P3 = 6.5, P4 = 6.5. In the third time variation (36 hours) with treatment P1, P2, P3, P4 given each dose of 2gr, 4gr, 6gr and 8gr there was a decrease in the pH level of the water, namely P1 = 7.2, P2 = 6.5, P3 = 6.4, P4= 6.4.

Based on the results of the analysis of research data obtained, it was found that in the P1 treatment there was a significant effect, namely a decrease in the PH level of the water from acid to neutral where the results were P1 (12 hours) water pH 7.9 and P1 (24 hours) water pH 7.4 and P1 (36 hours) the pH of the water is 7.2. Thus, it can be concluded that at a concentration of P1 = 2 g of Moringa seeds dissolved in 1 liter of water, it can reduce the pH level of alkaline water to neutral water pH levels. In contrast to experiments P2, P3, and P4 there was a decrease in water pH from alkaline water pH to acid water pH.

3.2 Measurement TDS (Total Dissolved Solids)

The data from the TDS measurement of the river water in Worongge Village can be seen in Table 4.

The results of the analysis of the TDS test data with the addition of Moringa seed extract, namely the first experiment (12 hours) the results from the treatment P0, P1, P2, P3 and P4 were 0.170, 0.182, 0.194, 0.185, 0.221, and in the second experiment (24 hours) the results obtained were 0.173, 0.196, 0.233, 0.223, 0.250, while in the third experiment (36 hours) the results were 0.177, 0.191, 0.231, 0.225, 0.263. From the results of the research above, it can be seen that there is an increase in dissolved substances in water as a result of adding Moringa seed extract, the solute serves to bind inorganic substances dissolved in water, the appropriate concentration used is P1 because the amount of substances that dissolve in water with the amount which is less and is associated with water pH levels in previous studies.

Based on Table 5 the ANOVA test using a 5% confidence value shows that $F_{count} 2.35 < F_{Table} 3.45$ then, it can be said that the treatment has a significant effect, then it is continued with the BNJ test (Honest Significant Difference).

Table 4. Water TDS measurement

Treatment	Time variation			Amount	Average
	12 hour	24 hour	36 hour		
P0(-)	0.17 mg/L	0.17 mg/L	0.17 mg/L	0.521	0.173
P1(2gr)	0.18 mg/L	0.19 mg/L	0.19 mg/L	0.569	0.190
P2 (4gr)	0.19 mg/L	0.23 mg/L	0.23 mg/L	0.658	0.219
P3(6gr)	0.18 mg/L	0.22 mg/L	0.22 mg/L	0.633	0.211
P4(8gr)	0.22 mg/L	0.25 mg/L	0.26 mg/L	0.734	0.244
Jumlah	0.953	1.075	1.087	3.115	1.038

Table 5. Anova test of TDS water

Variance	Degree of freedom	Number of square	Middle square	F-count	F-table	
					0.05	0.01
Treatment	4	-0.15	-0.29	-2.35	3.45	6
Fallibility	10	0.16	0.05			
Total	14	0.012013				

Table 6. Average of water TDS measurement

Treatment	Average	BNJ
P0	0.17	
P1	0.19	
P2	0.20	0.34
P3	0.21	
P4	0.24	

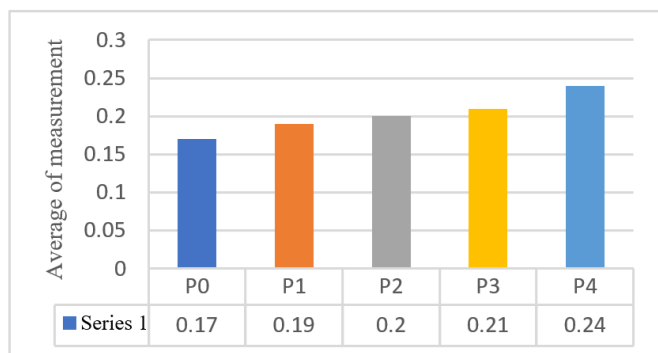


Figure 2. Water TDS measurement

Based on the BNJ test value in Table 6 at a 5% confidence level, it can be seen that in the P0 treatment the results (0.17) there were no significant differences in the effect of giving Moringa oleifera seed extract concentration in the P1, P2, P3 and P4 treatments on river water. which can be seen in Figure 2.

The results of the analysis of the TDS test data with the addition of Moringa seed extract, namely the first experiment (12 hours) the results from the P0, P1, P2, P3 and P4 treatments were 0.170, 0.182, 0.194, 0.185,0.221, and in the second experiment (24 hours) the results obtained were 0.173, 0.196, 0.233, 0.223, 0.250, while in the third experiment (36 hours) the results were 0.177, 0.191, 0.231, 0.225, 0.263. From the results of the research above, it can be seen that there is an increase in dissolved substances in water due to the addition of Moringa seed extract, the solute functions to bind inorganic substances dissolved in water, so the appropriate concentration used is P1 because the amount of substances dissolved in water is equal to the amount of water soluble. which is less and is associated with water pH levels in previous studies.

3.3 Turbidity measurement

The data from the measurement of river water turbidity in Worongnge Village can be seen in Table 7.

Based on the observations made, it was shown that the P1 concentration treatment showed a significant decrease in the level of water turbidity, namely from the first treatment level (12 hours) which was 50 NTU then to 47 NTU in the second treatment (24 hours) and became 46 NTU in the third treatment (36 hours), while in the concentration of P2, P3, and P4 there was no decreasing reaction.

Table 7. Turbidity measurement

Treatment	Time Variation			Average
	12 hour	24 hour	36 hour	
P0	50 NTU	50 NTU	50 NTU	50
P1	50 NTU	47 NTU	46 NTU	47,7
P2	50 NTU	55 NTU	55 NTU	50
P3	50 NTU	55 NTU	55 NTU	53,3
P4	50 NTU	55 NTU	55 NTU	53,3
Jumlah	250	262	251	254,3

Table 8. Anova test turbidity

Variance	Degree of Freedom	Number of square	Middle square	F-Table	
				F-count	0.05 0.01
Treatment	4	81.07	20.27	3.4	3.47 5.9
Fallibility	10	58.67	5.87		
Total	14	139.73			

Based on Table 8 the ANOVA test using a 5% confidence value shows that F count 3.45 > F Table 9 then, it can be said that the treatment has a significant effect, then it is continued with the BNJ test (Really Honest Difference).

Table 9. Average turbidity measurement

Treatment	Average	BNJ
P0	50	
P1	47.6	
P2	50	14.26
P3	53.33	
P4	53	

Based on the BNJ test value in Table 9 at a 5% confidence level, it can be seen that the P0 treatment with an average value of 50 was not significantly different from the P1, P2, P3 and P4 treatments which can be seen in Figure 3.

results were obtained at P0 = 50, P1 = 46, P2 = 55, P3=55 and P4=55.

So from the results of the study, it was found that the P1 treatment with a dose of 2gr was able to reduce the level of turbidity in river water for 36 consecutive hours, there was a decrease in the level of turbidity or turbidity. In accordance with the results obtained where the concentration of P1 with a dose of 2gr with a time of 36 hours, the results obtained water turbidity is 46 NTU.

4. CONCLUSIONS

From the experimental analysis to reduce the turbidity level of river water using natural coagulant Moringa seed (*Moringa oleifera*) it was found that natural coagulant from Moringa seed has an effect on reducing the level of turbidity of water and stabilizing the pH of the water and the water is fit for use. The most effective concentration of Moringa seed extract coagulant (*moringa oleifera*) to reduce the turbidity level of river water is P1 (2gr)/liter of river water. 7.2, water TDS 0.191, and turbidity (turbidity) 46. The use of Moringa oleifera seed extract as a natural coagulant is effective in reducing the turbidity of river water and the most effective concentration of Moringa oleifera seed extract as a coagulant to reduce water turbidity river is P1 (2gr)/liter of river water. The use of Moringa oleifera seed extract as a natural coagulant is effective in reducing the turbidity of river water.

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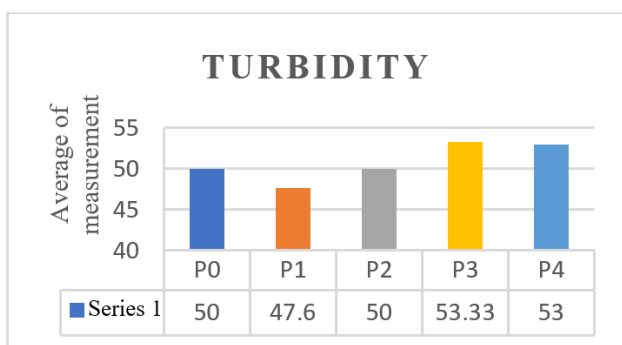


Figure 3. Water turbidity measurement

The results of data analysis on turbidity testing or the level of turbidity of water using a mixture of Moringa seed extract in 1 liter of water obtained the following research data:

In the first experiment (12 hours) with each treatment given P0 = no treatment, P1 = 2gr, P2 = 4gr, P3 = 6gr, P4 8gr obtained the same results there was no change, namely the turbidity level was at 50. In the experiment the second (24 hours) with each treatment given P0 = no treatment, P1 = 2gr, P2 = 4gr, P3 = 6gr, P4 8gr, the following results were obtained at P0 = 50, P1 = 47, P2 = 55, P3 = 55 and P4=55. In the third experiment (36 hours) with each treatment given P0 = no treatment, P1 = 2gr, P2 = 4gr, P3 = 6gr, P4 8gr, the following

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