Difference In The Effectiveness Of Moringa Seeds *(Moringa Oleifera Lam)* And Porang *(Amorphophallus Muelleri Blume)* To Reduce Water Turbidity

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Abstract. Water with high turbidity reduces the effectiveness of disinfectants and complicates the work of filtration units, as well as impacting health and the environment. It is necessary to treat water using alternative coagulants to chemical coagulants, such as Moringa seed powder (Moringa oleifera lam) and porang powder (Amorphophallus muelleri blume) which are stronger against friction during floc formation.The type of research quasi experiment and nonequivalent control group design. The research subject clean water from Reservoir and the research object was turbidity parameters. There were 3 variations of coagulant concentrations, those are 0,05 gr/l, 0,1 gr/l, and 0,2 gr/l. The results showed that the water purification process with an initial turbidity levels is 10,86 NTU, using moringa seed powder *(Moringa oleifera lam)* concentration of 0,05 gr/l reduced 0,57 NTU (94,73%), 0,1 gr/l reduced 0,78 NTU (92,77%), 0,2 gr/l reduced 1,52 NTU (85,93%), while porang powder *(Amorphophallus muelleri blume)* of 0,05 gr/l reduced 0,66 NTU (93,92%), 0,1 gr/l reduced 0,72 NTU (93,35%), 0,2 gr/l reduced 1,62 NTU (85,01%). Moringa seed powder *(Moringa oleifera lam)* with a reduction effectiveness of 85,93%-94,73% and porang powder *(Amorphophallus muelleri blume)* of 85,01%-93,92%. The results of the two-way anova test analysis, there are differences in the effectiveness of moringa seed powder *(Moringa oleifera lam)* and porang powder *(Amorphophallus muelleri blume)* to reduce turbidity in clean water. Suggestions for this study, namely the need to develop water purification methods using natural coagulants and add variations in settling time.

Keywords: Turbidity, Coagulant, Moringa Seeds *(Moringa oleifera lam)*, Porang *(Amorphophallus muelleri blume)*

1 BACKGROUND

The basic and meaningful need for life is water, because life is very dependent on water. The use of water is attached to humans for survival. An absolute component in the provision of clean water is the source of water. Various aspects that can affect water quality are physical, chemical, and bacteriological. Therefore, it is very necessary to maintain and treat water sources so that they do not have a negative impact on the environment and humans [7].

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In Indonesia, clean water supply is managed by PDAM. PDAM water is generally sourced from reservoirs or river. It can be proven that the quality of clean water originating from water bodies, such as reservoirs, does not meet the requirements for drinking water or clean water, and is even cloudy and mixed with mud because it comes from mountains which may have been polluted so it is not good for use [3]. Water containing high turbidity in the treatment process can reduce the effectiveness of the disinfectant, complicate the filtration unit work process, and of course the price is increasingly expensive. The impact on health can be at risk of digestive diseases, especially immunity caused by contamination from viruses or bacteria attached to suspended solids in water. Impact on the environment can interfere with the process of respiration and metabolism for organisms in the water, interfere with the entry of sunlight, and can affect the pattern and optical properties in the waters. Therefore, it is necessary to treat clean water [5].

One of the processes of treating clean water, especially water bodies, is chemically and physically, such as coagulation and flocculation which is followed by sedimentation which usually uses alum as a coagulant. However, the use of alum as a coagulant can have negative impacts on human health, such as kidney damage and the volume of sediment produced is large and toxic because aluminum is involved in triggering neurological disorders [23]. Therefore, it is necessary to have alternative coagulants, such as plants which are not difficult to find or are called organic coagulants. The coagulant is rarely used for purification of clean water, namely moringa seed powder *(Moringa oleifera lam)* and porang powder *(Amorphophallus muelleri blume)* [14]. Use of moringa seed powder *(Moringa oleifera lam)* and porang powder *(Amorphophallus muelleri blume)* more economical and environmentally friendly than chemical coagulants. Not only that, natural coagulants are stronger against friction during floc formation [20].

Moringa seed powder *(Moringa oleifera lam)* It contains positively charged proteins and can dissolve in water [4]. So that the protein can function as a coagulant to replace coagulants from synthetic chemicals that are widely used. If the coagulant is dissolved in water, it will become a positively charged cation, and the cation is able to attract or bind negatively charged impurities in the water [15]. Moringa seeds *(Moringa oleifera lam)* can also prevent dysentery and cholera [2].

One of the water purification materials that can precipitate suspended sludge in water sourced from surface water and as a binder for colloidally suspended minerals in mining is glucomannan. Glucomannan is a form of carbohydrate derivative polysaccharides are water soluble. Porang contains glucomannan *(Amorphophallus muelleri blume)* 3.58%, 0.92% protein, and other ingredients can nourish the body [8] [11].

From the description above, the use of natural coagulants such as moringa seed powder *(Moringa oleifera lam)* and porang powder *(Amorphophallus muelleri blume)* It is possible to replace chemical coagulants, such as alum [10]. According to [1] [9] the reduction in water turbidity is around 36- 98.2% with a concentration of moringa seeds *(Moringa oleifera lam)* of 0.1 gr/l – 0.450 gr/l. Based on the preliminary test, the initial turbidity result was 10.03 NTU and after testing with a concentration of 0.1 g/l Moringa seed powder *(Moringa oleifera lam)* the results obtained were 0.67 NTU

(93.3%). At a concentration of 0.1 g/l porang powder *(Amorphophallus muelleri blume)* the result was 0.4 NTU (96%). The data above shows that these materials have the potential as coagulants.

2 Research Methods

This research uses a quasi-experimental type with a nonequivalent control group design that is, there is only an experimental group and a comparison group (control) and are not randomly selected. The subject of this research is clean water from the Gonggang Reservoir, the object of research is the turbidity parameter. The sampling technique used composite time sample. Data analysis used two-way anova.
The research phase carried out:

2.1 Coagulant Preparation Stage

Making Moringa seed powder (Moringa oleifera lam). Prepare tools and materials, take old Moringa seeds (Moringa oleifera lam) and peel the skin, put Moringa seeds (Moringa oleifera lam) into a porcelain cup and dry using an oven at 105 ° C for 10 minutes, wait until it cools and grind the seeds using a blender, then sift with a sieve size of about ± 60 mesh.

Making Porang powder (Amorphophallus muelleri blume). Soak the tuber pieces with 5% NaCI solution for 20 minutes and add saline solution to remove oxalic acid, rinse the tubers with water, dry the tuber pieces for ± 5 days until completely dry and mash, add phosphate citrate buffer pH 5 to the tuber pieces that have been mashed into a 5% solution, heat the solution with an electric heater at a temperature of 95°C, If the solution has been gelatinized, add the enzyme a-amylase as much as 1 ml and wait for the hydrolysis process for 45 minutes, and add 0.1 N HCI, After that, add 0.1 N NaOH to neutralize the pH, Add 100 ml cold distilled water and do a centrifugal process to set aside coarse fibers and glucomannan thick solution and cool in the refrigerator for 1 hour, add 96% ethanol, filter the precipitate then dry and mash. Then sift about ±60 mesh [13].

2.2 Clean Water Sampling At Gonggang Reservoir

Prepare the necessary equipment. The sampling technique uses a composite time sample (SNI 6989.59:2008).

2.3 Concentration Measurement

Prepare the necessary tools and materials, turn on the analytical balance, weigh the Moringa seed powder *(Moringa oleifera lam)* and porang powder *(Amorphophallus muelleri blume)* with concentrations of 0.05 gr/l, 0.1 gr/l, and 0.2 gr/l.

2.4 Coagulant Testing Using The Jartest Method

Moringa seed powder *(Moringa oleifera lam)* and porang powder *(Moringa oleifera lam)* were put into each glass beaker, stirring fast 150 rpm for 5 minutes and continued with slow stirring 30 rpm for 3 minutes, let stand for 1 hour for floc settling. An adsorption process occurs with the following mechanism:

$-Y-OH+M^{+} \leftrightarrow -YO-M+H^{+}$

$-Y-OH+M^{2+} \leftrightarrow -YO-M$ ⟩ $M+2H^{+}$

$-YO-M$ ⟩

M^{+} dan M^{2+} dalam penelitian ini merupakan ion penyebab kekeruhan, -OH merupakan gugus hidroksil, dan Y merupakan matriks tempat gugus –OH terikat [6] [16].

2.5 Examination Of Turbidity Levels After And Before Treatment

Turn on the device, put the sample into the sample bottle and then insert it into the hole of the device, and record the results after and before treatment.

3 Research Results

Research results of Moringa Seed Powder *(Moringa oleifera lam)* and Porang Powder *(Amorphophallus muelleri blume)* as shown in Fig. 1:

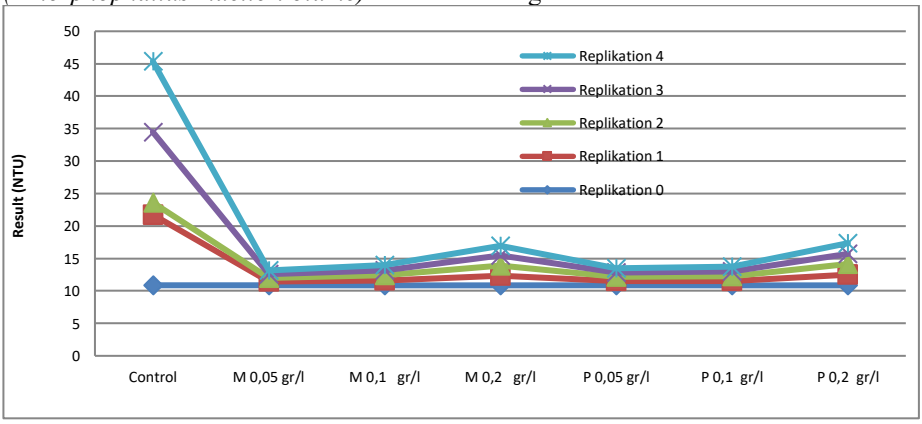

Fig. 1. The results of the difference in the reduction of turbidity levels.

Based on Fig 1, it is known that the results of differences in turbidity reduction are most effective using moringa seed powder *(Moringa oleifera lam)* with variations in concentration of 0.05 gr/l with a decrease of 0.57 NTU, while the addition of porang powder *(Amorphophallus muelleri blume)* with variations in concentration of 0.05 gr/l with a decrease of 0.66 NTU. The statistical analysis Two Way Anova Test (Two-Way Anova) is shown in Table 1.

Table 1. Homogeneity Test Results

F	Df1	Df2	Sig.
1.143	6	21	.373

Based on Table 1, it can be seen that the value is 0.373 > 0.05, so it can be concluded that the data that has been obtained is homogeneous.

Table 2. Two Way Anova Statistical Test

Source	Type III Sum Of Squares	df	Mean Square	F	Sig.	Partial Eta Squarel
Treatment	.011	1	.011	47.168	.000	.692
Coagulant concentration	4.374	2	2.187	9.519E3	.000	.999
Treatment* Coagulant Concentration	.033	2	.017	72.466	.000	.873

The results of the two-way Anova analysis showed a large ρ-value value in the treatment variable, which is 0.000 < 0.05 which means H1 is accepted and it can be concluded that there is a difference in the effectiveness of the control treatment, Moringa seed powder *(Moringa oleifera lam)* and porang powder *(Amorphophallus muelleri blume)* to reduce turbidity in clean water (Table 2).

The results of the two-way Anova analysis showed a large ρ-value value in the coagulant concentration variable, which is 0.000 < 0.05 which means H1 is accepted and it can be concluded that there is a difference in the effectiveness of coagulant concentrations of 0 g/l, 0.05 g/l, 0.1 g/l, and 0.2 g/l using moringa seed powder *(Moringa oleifera lam)* and porang powder *(Amorphophallus muelleri blume)* to reduce turbidity in clean water.

The results of the two-way Anova analysis showed a large ρ-value value in the interaction between the treatment variable and the coagulant concentration, which is 0.000 < 0.05 which means H1 is accepted and it can be concluded that there is an interaction between the treatment variable and the coagulant concentration on the difference in coagulant effectiveness to reduce turbidity in clean water.

4 Discussion

The physical condition of water is brownish and turbid caused by organic matter derived from the decay of plants and animals in water and inorganic matter, such as mud. The amount of turbidity depends on the material contained in these waters [24]. According to [5], high turbidity can cause various negative impacts on living things and the surrounding environment. In addition, turbidity also negatively affects water treatment because it complicates the work process of the filtration unit, reduces the effectiveness of disinfecting, and costs more. So it is necessary to do processing to reduce turbidity levels, namely using moringa seed powder *(Moringa oleifera lam)* and porang powder *(Amorphophallus muelleri blume).*

According to [1] that water turbidity can be reduced by around 36-98.2% using Moringa seed powder *(Moringa oleifera lam)* with a concentration of 0.1 gr/l-0.450 g/l, so that in this study using Moringa seed powder (*Moringa oleifera lam)* with a concentration of 0.1 g/l (93.05%), but more optimally using Moringa seed powder *(Moringa oleifera lam)* with a concentration of 0.05 g/l (94.73%).
Protein found in Moringa seeds *(Moringa oleifera lam)* as much as 32.19 g. In the coagulation process with the amino acid content in Moringa seed protein *(Moringa oleifera lam)* will ionize and produce carboxylate and H + charges which will attract colloidal particles (impurities) in the neutralized medium and precipitate as floc [21] [12].

Porang *(Amorphophallus muelleri blume)* has a glucomannan content of 64.98% in powder form. Glucomannan is a kind of neutral polysaccharide that has the advantages of biocompatibility and biodegradable activity [17]. Glucomannan has a spherical macroporous gel consisting of glucose and mannose. Glucomannan gel is hydrophilic and has large pores and mechanical strength. In addition, glucomannan has abundant hydrophilic OH groups and provides good water solubility and is widely used as a positively charged bio-flocculant to absorb anionic contaminants (colloids). The process of decreasing turbidity occurs because the active OH group contained in glucomannan can bind turbidity to clean water, so that the more adsorbent mass, the more OH active groups are produced in binding turbidity-causing ions. However, the mass of the adsorbent used must be adjusted to the time used for the settling process. Because at high concentrations it requires a longer settling time compared to low concentrations. The active group OH in glucomannan causes polar properties in adsorbents. Glucomannan can adsorb Cr more than 92% with a concentration of 6.0 g / l in less than the first ten minutes and shows a fairly fast adsorption rate. Chains of macromolecular components in glucomannan assemble and form tissue structures that are very much useful for adsorption processes and impurity particle capture [15].
The adsorption mechanism occurs between the OH- group attached to the surface with positively charged turbidity-causing ions (cations). Here is the adsorption mechanism [6]. The use of glucomannan as cationic flocculant shows the occurrence of complete flocculation in eliminating high turbidity [19].

The results of the difference in the effectiveness of moringa seed powder *(Moringa oleifera lam)* and porang powder *(Amorphophallus muelleri blume)* with a variation in concentration of 0.05 gr/l with effectiveness reduction of 94.73% and 93.92%. This

shows that Moringa seed powder *(Moringa oleifera lam)* and porang powder *(Amorphophallus muelleri blume)* are more effective for reducing the turbidity of clean water with a concentration of 0.05 gr/l, When compared with a concentration of 0.1 gr/l with an effectiveness reduction of 92.77% and 93.35%, and a concentration of 0.2 gr/l with an effectiveness reduction of 85.93% and 85.01%.

The effectiveness of reducing turbidity levels shows that the greater the concentration of coagulants used, the less effective the decrease because it is influenced by the deposition time which must be in accordance with the given concentration. Vice versa, if the concentration of coagulants used is small, then the effectiveness of the decrease will be even greater. Based on the results of the study above, with the same concentration, which is 0.05 g/l shows Moringa seed powder *(Moringa oleifera lam)* is better for reducing turbidity compared to porang powder *(Amorphophallus muelleri blume)*. However, the effectiveness between Moringa seed powder *(Moringa oleifera lam)* and porang powder *(Amorphophallus muelleri blume)* is still above 90%. This shows that floc formation in Moringa seed powder *(Moringa oleifera lam)* is more effective than porang powder *(Amorphophallus muelleri blume).* Based on the results of [18], that the factors that affect the process of floc formation, namely the provision of concentration must be in accordance with the needs and must adjust to the deposition time needed by the floc. The concentration of coagulant required to decrease turbidity cannot be estimated based on turbidity, but must be determined through a decrease experiment by looking at the final condition.

In addition, the use of the adsorption method before the floc formation process is influenced by the surface area of the adsorbent. The finer the shape of a substance to the same mass will result in the more surface area of the substance [25]. The greater the surface area, the greater the adsorption power, because the adsorption process occurs on the adsorbent surface. The adsorbent used in this study is in the form of a powder with a size of 60 mesh to optimize the absorption process between the adsorbent and the solution. In powder form, the number of lots, and small size allow the impact area to be much larger. According to collision theory "the more surface area of particles, the greater the likelihood of collisions between particles" [22].

Two-Way Anova Test. The results of turbidity analysis using the two-way anova test obtained $\rho < \alpha = 0.000 < 0.05$, showing that there are differences in the effectiveness of Moringa seed powder *(Moringa oleifera lam)* and porang powder *(Amorphophallus muelleri blume)* to reduce turbidity in clean water.

5 Conclusion

The difference in the effectiveness of Moringa seed powder *(Moringa oleifera lam)* and porang powder *(Amorphophallus muelleri blume)* to reduce turbidity in clean water is the most effective, namely the addition of Moringa seed powder *(Moringa oleifera lam)* with a concentration variation of 0.05 gr/l with an effectiveness reduction of 94.73%, while porang powder *(Amorphophallus muelleri blume)* concentration variation of 0.05 g/l with an effectiveness reduction of 93.92%.

It is necessary to develop water purification methods using natural coagulants, such as moringa seed powder *(Moringa oleifera lam)* and porang powder *(Amorphophallus muelleri blume)*. Researchers can then add variables used, such as variations in precipitation time.

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