

The Effectiveness of Moringa Seed Powder as Coagulant in Reducing Turbidity of Water Containing Iron Ion in 2017

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Abstract— Ground water is a source of clean water that is often used by people for daily activities. Physically, clean water is colorless, odorless, tasteless, and not turbid. Turbidity and levels of iron ions in ground water can be lowered by using moringa (*Moringa oleifera*) seed powder as coagulant. Niazynin A and Niazynin B as well as 4-Alfa-4rhamnosxylopsi-benzil-isothioncyanate in moringa can neutralize mud and metal particles on ground water. Moringa seed powder as coagulant is used to coagulation process with jar-test. Based on the experimental test, the yield of turbidity degradation was effective at concentration of 1140 mg by 68%, which can decrease the iron ion content by 78% with the average temperature of 30.4°C and the average pH of 6.5. The height of coconut shell charcoal on a fast-sand sieve of 15 cm to 25 cm is effective as an absorbant in removing the residual flavor and odor of the moringa seed powder after the coagulation process.

Keyword: Moringa Seed Powder, Ground Water, Coconut Shell Charcoal

1. INTRODUCTION

Water is the necessity of all living things. It is not only humans who need water, but animals, plants and other living things also need water in their lives. One source of clean water that is most often used by people for daily activities is ground water. Ground water is widely used by people from any circle. Besides being easily available, this ground water is also always available under the ground and does not need to pay for it. However, its availability to meet daily needs depends on several factors, namely geological and geographical factors of the land.

Ground water can be polluted both chemically and physically. Physically clean water is colorless, odorless, tasteless and not cloudy. Clean water also can be seen in terms of bacteriological and chemical levels of ground water. The chemical level of ground water depends on the lithosphere formation that passes through it, and there may be pollution from the surrounding environment. In the soil minerals can dissolve and be carried away by the water flow (Said, 2012). Thus, it can affect the quality of ground water, one of which is geographic and geological conditions where water sources have different characteristics. The geological condition that affects the quality of chemical ground water is excessive iron elements in soil carrying water, for example, in areas used to be swamps and rice fields are now housing, but not only iron metal can be contaminated with ground water, contamination of other metals can also occur like manganese, calcium, chlorine and others.

Iron (Fe) and Manganese (Mn) that contained in ground water is quite large. The content of Fe and Mn in water cause the color of the water to turn brownish yellow after having contact with air for a while. Besides, it can interfere with health. It causes unpleasant odors and causes the yellow color of the bath. The water becomes cloudy and it can damage the intestinal wall which can eventually cause death. According to the Republic of Indonesia Minister of Health Regulation Number 32 / / Per / IX / 2017 concerning the requirements for clean water quality, the iron content allowed is 1.0 mg / l and turbidity of water is 25 scales of NTU (Ministry of Health, 2017). Therefore, ground water treatment is necessary. To improve the quality of ground water that will be used by the community, ground water treatment can be done in various ways, ranging from simple and inexpensive ones such as the use of natural coagulants like Moringa seeds and can also use modern technology in accordance with the level of ground water quality as raw water to be processed. Water treatments in big cities so far were by adding synthetic coagulants from

chemicals such as alum to agglomerate small soil particles in the water with stirring for a while then deposited for some time. Thus, the upper part of the water (already clear) can be separated to be used for daily life by the people. The use of synthetic (chemical) coagulant is very dangerous for human health and it needs to be controlled for its use. From this background, the researchers want to try the use of natural coagulants namely *Moringa oleifera* powder coagulant in reducing turbidity of ground water that contained iron ions.

The research conducted by Arung in Yusrin (2015) concerns on the use of *Moringa* seeds as a coagulant in turbidity and decreased levels of heavy metal elements (Fe, Mn, Cu, Cr) in water. The result of Arung's research is that *Moringa* seeds can change cloudy water with soil particles, mud, and metal elements into water that is suitable for consumption and meets quality standards even though it still leaves a slight taste of *moringa*. Meanwhile, the result of Srawaili's study (2008) using *moringa* seed powder as much as 1150mg / l can reduce turbidity of ground water up to 99.868%. The concentration is used for further testing. In connection with this matter, the researchers intend to conduct research on the trial of the effectiveness of *Moringa* seed powder in reducing turbidity of ground water that contained iron ions. Ground water in the housing for rent Jalan Pahlawan Gang Mesjid No. 74 RT 06 / RW 011 Bulak Ship East Bekasi, West Java was used as a sample in this research. Judging from the environmental conditions of the rented house, formerly the rice fields, ponds and swamps were piled up with land and used as rented housing, where behind this housing there are still swamps and prisons. The purpose of this research is to determine the effectiveness of *moringa* seed powder coagulants in reducing turbidity of ground water that contained iron (Fe) ions.

2. MATERIALS AND METHOD

In this research, the researchers use a quasi-experimental method to determine the effective concentration of *Moringa oleifera* seeds in reducing turbidity and iron ion levels of ground water.

Turbidity and levels of iron ions in the ground water can be lowered by using *Moringa oleifera* seed powder as coagulant. The active ingredients contained in other *Moringa* seeds include Niazinin A and Niazinin B, Olei Vaccenic Acid, 4-alfa-4rhhamnosyloxy-benzil, and isothioncyanate. From some of the active ingredients, one of them is capable of absorbing and neutralizing mud particles and the metal contained 4-alfa-4rhamnosxylopsi-benzil-isothioncyanate in suspension wastewater. In addition, coconut shell charcoal is used to remove residual taste and odor from *moringa* seed powder after the coagulation process.

This research was carried out in the Environmental Chemistry Laboratory of the Department of Health Health Department of Health Polytechnic Jakarta II in the period of August-September 2017. The ground water sample in this research was taken from well bore water in the rented housing in Jalan Pahlawan, gang Mesjid No 74 RT 06 / RW 011 Bulak Kapal-Bekasi Timur, West Java.

The initial process in this research was making *moringa* seed powder by sifting using Mess 40. After that, the process was continued with the manufacture of a quick sand filter with the addition of coconut shell charcoal as an absorbent. In this research, to calculate the amount of class interval (*moringa* powder concentration) the researchers used the formula as follows (Listya, 2011),

$$CI = \frac{R}{C}$$

Where:

CI = large class interval

C = number of classes

R = the largest data range - the smallest data.

In order to obtain representative results from this research, replication is needed. To calculate the amount of replication, the researchers calculated by the following formula (Sugandhi and Sugiarto, 1994),

$$t(r - 1) \geq 20$$

Where:

t = treatment

r = number of replications to be carried out.

Each coagulation process was conducted using a jar-test with a rotation speed of 100 rpm for 1 minute and 60 rpm for 10 minutes, then stayed for 60 minutes to carry out turbidity checking with the Orbego Turbidimeter and iron ion levels with Nova Spectrophotometer. In addition, the examination was also conducted on temperature with water thermoter and on pH measurement with universal pH stick.

3. RESULTS AND DISCUSSION

To obtain the concentration of moringa seed powder, a preliminary test was conducted by doing initial measurements on turbidity, iron ion levels, temperature and pH of the ground water sample. The results of the preliminary test can be seen in Table 1.

Table 1. Preliminary Test Results

No	Type of examination	Results
1	Level of Turbidity	27,4 NTU
2	Iron ion level	3,53 ppm/l
3	pH	7
4	Temperature	30°C

Source: Processed Primary Data, 2017

Based on the results of the initial examination conducted at the Jakarta Poltekes II Environmental Health laboratory, the turbidity level in the ground water sample before processing was 27.4 NTU, while the iron content was 3.53 mg / l. According to Minister of Health Regulation No. 32 / Menkes / Per / IX / 2017, the requirements for quality of clean water and the permissible levels of turbidity are 25 NTU and 1 mg / l of iron content. In other words, water sample from home No. 74 RT 06 / RW 11 Jalan Pahlawan Bulak Kapal, Bekasi Timur did not meet the requirements for clean water quality.

The actual test results with five replicates of Moringa seed powder in reducing iron ion levels can be seen in Table 2.

Table 2. Average Results of Decreasing Iron Ion Levels After Treatment

No	Moringa seed powder concentration (mg/l)	Iron content before (mg/l)	Iron content after processing (mg/l)	Difference	Decreased iron content (%)
1	Control	3,53	2,24	1,29	36,5
2	980	3,53	2,24	1,29	36,5
3	1060	3,53	0,90	2,63	74,5
4	1140	3,53	0,75	2,78	78,6
5	1220	3,53	0,86	2,67	75,6
6	1300	3,53	1,06	2,47	70

Source: Processed Primary Data, 2017

From Table 2 above, it can be seen that the concentration of moringa seed powder of 1140 mg / l is effective in reducing iron ion levels by 78.6%. The differences in the characteristics of the ground water and river water greatly influence the coagulation process. The characteristics and types of moringa also have an influence on the coagulation process. In the world, there are 13 species of Moringa Oleifera which are spread in tropical regions such as Africa, Latin America and Madagascar. These differences in Moringa tree species also affect the content of the active ingredient, 4-alfa-4-rhhamnosyloxy-benzil-isothiocyanate which is able to absorb and neutralize particles of mud and metals contained in the ground water.

The effectiveness of processing or reducing iron content in the ground water sample is coagulant of moringa seed powder with concentrations of 980 mg, 1060 mg, 1140 mg, 1220 mg, and 1300 mg that was listed in Table 2. Meanwhile, the ineffective ones are coagulant of Moringa seed powder with a concentration of 980

mg and 1300 mg because it exceeds the allowed quality standard (1.0 mg/l) for iron content.

The results of the actual test with five replicates of Moringa seed powder in reducing turbidity can be seen in table 3 as follows.

Table 3. Average Turbidity After Treatment

Replication	Variation of Moringa seed powder concentration (mg/l)					
	Control	980	1060	1140	1220	1300
Replication 1	3,10	2,08	0,90	0,80	0,82	1,06
Replication 2	2,94	2,16	0,94	0,75	0,86	1,10
Replication 3	3,06	2,12	0,86	0,78	0,90	1,14
Replication 4	2,94	2,27	0,94	0,78	0,90	1,10
Replication 5	3,06	2,24	0,90	0,75	0,86	1,06
Average	3,02	2,17	0,91	0,77	0,87	1,09
Decrease	0,51	1,36	2,62	2,76	2,66	2,44
Decrease (%)	14	38	74	78	75	69

Source: Processed Primary Data, 2017

From Table 3, it can be seen that the concentration of moringa seed powder of 1140mg / l is effective in reducing turbidity by 78%. For turbidity levels. all concentrations have the quality standard requirements (25 NTU). Muhibi and Edison's 1995 research results in Pramono (2011) Moringa seed extract can eliminate turbidity of 92-95%, as effective as using alum. There are 6 types of Moringa Oleifera moringa, where each type has different coagulant capabilities for purification of ground water and river water.

The results of the actual test with five replications of Moringa seed powder in the measurement of temperature and pH of water can be seen in Table 4 as follows.

Table 4. Average Results of Measurement of pH and Temperature of Water During Observation of Kogulation of Moringa Seed Powder Against Decrease in Ground water Roughness

No	Concentration	pH		Temperature (°C)	
		Before	After	Before	After
1	Control	7	7	30	30.4
2	980	7	6.5	30	30.4
3	1060	7	6.5	30	30.4
4	1140	7	6.5	30	30.4
5	1220	7	7	30	30.4
6	1300	7	7	30	30.4

Source: Processed Primary Data, 2017

From Table 4, it can be seen that the pH decreases at a concentration of 9.80 mg, 1060 mg, 1140 mg from pH 7 to 6.5, while the average temperature increases from 30 ° C to 30.4 ° C. This is because replication 2 and 3 are done during the day.

The results of the actual test with three replicates of Moringa seed powder in removing residual taste and odor can be seen in Table 5 as follows.

Table 5. Results of Odor and Taste After Screening

The height of coconut shell charcoal (cm)	Replication 1		Replication 2		Replication 3	
	Odor	Taste	Odor	Taste	Odor	Taste
5	+	+	+	+	+	+
10	+	+	+	+	+	+
15	-	-	-	-	-	-
20	-	-	-	-	-	-
25	-	-	-	-	-	-

Source: Processed Primary Data, 2017

Where:

+ = still tastes and odor

- = tasteless and odor

The use of moringa seed powder functions as a coagulant to agglomerate mud particles, particles of iron ions and other elements contained in ground water. After determining the effective concentration, filtering is conducted with a quick sand filter with variations in the height of coconut shell charcoal. To remove residual odor and taste from a moringa seed, the height of coconut shell charcoal is effective at an altitude of 15 cm, 20 cm, and 25 cm.

4. CONCLUSION

The use of Moringa seed powder coagulant was effective in reducing turbidity levels and iron ion levels at a concentration of 1140 mg/l with an average temperature of 30.4° C and a pH of 6.5. In addition, the use of a quick sand filter using coconut shell charcoal as an absorbent in removing residual odor and taste from moringa seed powder after the coagulation process is effective at absorbance heights of 15 cm to 25 cm.

For further research, the need for the selection of *Moringa oleifera* seeds has high and good active ingredients. Meanwhile, the difference in Moringa tree species also affect the content of the active ingredients: 4-alpha-4-rhamnosyloxy benzyl Isothiocyanate.

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