Effect of Precipitation Time of Moringa Seed Powder (Moringa Oleifera) and Tamarind Seed (Tamarindus Indica L) as Coagulant in Reducing Bod and TSS of Domestic Wastewater

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ABSTRACT

Wastewater treatment can be carried out through coagulation and flocculation processes by utilizing moringa seed powder and tamarind seeds as coagulants, which are proven to improve wastewater quality. This research aims to determine the effect of deposition time on the decrease in BOD and TSS. This type of research was a quasi-experimental with 3 replications at the time of deposition for 30 and 60 minutes of moringa seed powder and tamarind seed powder with a dose of 4.5 mg/l and the same stirring speed. The results showed that the percentage reduction in BOD for deposition time at 30 and 60 minutes of moringa seed powder was 65.54% and 72.57%, respectively. The decrease in TSS was 70.52% and 72.89. Deposition of 30 and 60 minutes of tamarind seed powder to decrease BOD was 62.34% and 64.58%, respectively. The decrease in TSS was 72.98% and 84.03%. The results of statistical tests for BOD significant value of 30 and 60 minutes of deposition of moringa seed powder are 0.008 and 0.007<0.05, for TSS that is 0.002 and 0.014<0.05. BOD significant value 30 and 60 minutes of deposition of tamarind seed powder was 0.019 and 0.018 <0.05, for TSS it is 0.006 and 0.004 <0.05. The conclusion of this research is that there is a significant effect of deposition time of moringa seed powder and tamarind seed on the reduction of BOD and TSS. The largest decrease in BOD was produced by moringa seed powder and the largest decrease in TSS was produced by tamarind seed powder. The next stage of processing should be carried out so that the levels of BOD and TSS after being processed using moringa seed powder and tamarind seed can meet the standard.

Keywords: BOD, Tamarind Seed, Moringa Seed Powder, TSS

INTRODUCTION

Wastewater is the residual water resulting from all human activities and generally contains substances or materials that can interfere with environmental quality and are harmful to health. Various types of wastewater can be found, one of which is domestic wastewater from food stalls. In general, waste water from food stalls is usually discharged into sewers without any prior treatment which can allow pollution of the surrounding environment, especially water bodies and cause health problems. So it is necessary to do processing that has the potential to prevent environmental pollution.

Wastewater treatment methods can be carried out through coagulation and flocculation activities. Coagulation is the process of destabilizing colloidal and suspended particles through rapid stirring so that it can accelerate the spread of coagulant in the treated water. Flocculation is the process of forming unstable colloidal particles into particles that can be precipitated by forming large particle sizes through slow stirring (Setyawati, *et al.* 2018). In coagulation and flocculation, coagulant materials are needed that can destabilize and bind to particles in wastewater that form large flocks so that they can easily settle.

The types of coagulants that are widely used to treat wastewater are inorganic coagulants such as *Poly-aluminum chloride* (PAC) and alum. But, from many studies conducted, it was found that processing with

inorganic coagulants is not environmentally friendly and can cause health problems compared to organic coagulants. Therefore, an alternative coagulant from organic materials that is environmentally friendly, economical and easy to find is needed to be able to treat wastewater quality to be good.

Alternative organic coagulants that can be used in treating wastewater are moringa seed powder and tamarind seeds. Moringa seed powder contains proteins that have a positive charge and act as cationic polyelectrolytes that can be used to purify water (Affandi N.N, 2019). Wastewater treatment with Moringa seed powder has been shown to reduce ammonia, TSS and BOD levels in wastewater.

The related research is Setyawati, *et a*l. (2018) which states that a dose of 2000 mg/l of Moringa seed powder can reduce BOD to 100 mg/l. Meanwhile, tamarind seed powder can also be used as a coagulant to treat wastewater because it contains proteins that act as polyelectrolytes. In addition, tamarind seeds contain a -NH3+ group which functions to bind particles with a negative charge, so they can bind to form larger particles and can be easily deposited (Soumena R, 2017). Research that uses tamarind seeds as a coagulant is Soumena R. (2017) which states that tamarind seed powder at a dose of 8000 mg/l can reduce COD and BOD levels of tofu industrial wastewater. The purpose of this study was to determine the effect of the time of deposition of moringa seed powder and tamarind seeds on the reduction of BOD and TSS of domestic wastewater.

MATERIAL AND METHOD

This type of research is a quasi-experimental research location at shop Coto and Pallu Basa Banta-Bantaeng as a sampling location and the Water Laboratory of the Environmental Health Department of the Makassar Health Polytechnic as a place for processing and inspection. The wastewater sampling technique used is a grab sample with a processing process that utilizes moringa seed powder and tamarind seeds as much as 4.5 g/l and stirred using a floculator at a speed of 100 rpm for 15 minutes and 60 rpm for 10 minutes. Then deposition was carried out for 30 and 60 minutes and laboratory examinations were carried out to determine the levels of BOD and TSS.

Data from the laboratory results were processed using a calculator and statistical test of t- paired samples presented in tabular form to determine the effect of settling time on the reduction of BOD and TSS of domestic wastewater.

RESULTS

1. BOD and TSS Levels Variation of Precipitation Time of Moringa Seed Powder

Table 1. BOD and TSS of Wastewater Sedimentation 30 Minutes Moringa Seed Powder

Parameters	Before (mg/l)	Control (mg/l)	Moringa Seed Powder		
			After (mg/l)	Reduction	Percentage (%)
BOD	260.65	198.53	89.81	170.84	65.54
TSS	380	309.33	112	268	70.52

Source: primary data, 2021

Table 2. BOD and TSS Wastewater Sedimentation 60 Minutes Moringa Seed Powder

Parameters	Before (mg/l)	Control (mg/l)	Moringa Seed Powder		
			After (mg/l)	Reduction	Percentage (%)

BOD	260.65	186,03	71,48	189,17	72,57
TSS	380	274	102,67	277,33	72,98

Source: primary data, 2021

2. BOD and TSS Levels Variation of Precipitation Time of Tamarind Seed Powder

Table 3. BOD and TSS Wastewater Sedimentation 30 Minutes Tamarind Seed Powder

Parameters	Before (mg/l)	Control (mg/l)	Tamarind Seed Powder		
			After (mg/l)	Reduction	Percentage (%)
BOD	260.65	198.53	98.15	162.5	62.34
TSS	380	309.33	102.67	277.33	72.98

Source: primary data, 2021

Table 4. BOD and TSS Wastewater

Parameters	Before (mg/l)	Control (mg/l)	Tamarind Seed Powder		
			After (mg/l)	Reduction	Percentage (%)
BOD	260.65	186.03	92.31	168.34	64.58
TSS	380	274	60.66	319.34	84.03

Source: primary data, 2021

DISCUSSION

1. Reduction BOD and TSS Levels of Moringa Seed Powder Variations in Deposition Time

Based on the results of the study, the percentage reduction in BOD and TSS with Moringa seed powder as a coagulant resulted in a greater decrease than the control sample. This happens because the Moringa seeds contain a protein that has a positive charge that acts as a cationic polyelectrolyte and an active substance, namely rhamnosyloxy-benzyl isothiocyanate. These active substances can neutralize and adsorb particles and metals present in wastewater (Rachmania KA, 2017).

While the use of controls in this study with the same precipitation variation treatment resulted in lower levels of BOD and TSS compared to the use of coagulants. This is because there is no addition of coagulant material that functions to accelerate the formation of larger flocks after stirring so that the provision of settling time to allow time for the formed flocks to settle cannot occur optimally in the control.

In the treatment of variations in settling time for 30 minutes and 60 minutes, the results showed that a settling time of 60 minutes with the use of Moringa seed powder resulted in lower BOD and TSS levels than the 30 minute deposition time. These results indicate that the longer the deposition time given after the coagulation and flocculation processes, the greater the decrease in BOD and TSS that occurs.

2. Reduction BOD and TSS Levels of Tamarind Seed Powder Variations in Deposition Time

Based on the results of the study, the use of tamarind seed powder resulted in a large decrease in BOD and TSS compared to the control without the addition of coagulant. According to Hayati (2015), tamarind seeds contain proteins that have a role as polyelectrolytes which can facilitate the process of flock formation, so that larger particles will form and are easy to precipitate. Tamarind seed powder also contains tannins which can inhibit the growth of bacteria in wastewater so that the BOD and TSS of wastewater can be reduced.

Giving 30 minutes and 60 minutes of settling time using tamarind seed powder to decrease BOD and TSS, showed that at 60 minutes of deposition the percentage decrease in BOD and TSS levels was greater than the 30 minute deposition time. So that the longer the deposition time, the greater the decrease in BOD and TSS levels that occur.

3. Comparison of BOD and TSS Reduction with Variation of Precipitation of Moringa Seed Powder and Tamarind Seed

The highest percentage decrease in BOD levels occurred in the use of Moringa seed powder both at 30 minutes and 60 minutes of deposition time, compared to the use of tamarind seed powder. This happens because in the Moringa seed powder there are substances that can bind particles and form macro flocks and settle on giving a settling time so that they can set aside organic substances in wastewater. Reduced organic matter can cause dissolved oxygen in wastewater to increase which causes BOD levels to decrease.

While the highest percentage reduction in TSS levels was produced by the use of tamarind seed powder with precipitation of 60 minutes compared to the use of Moringa seed powder. This happened because the content of tamarind seeds produced larger flock, thereby lowering TSS levels properly. Based on the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia No. 68 of 2016 concerning Domestic Wastewater Quality Standards, the maximum level for each BOD and TSS is 30 mg/l. So that the levels of BOD and TSS in wastewater after treatment using either moringa seed powder, tamarind seeds or controls have not met the applicable standards.

According to Husaini (2018), coagulation-flocculation is an interrelated process, where fast stirring is required for coagulation while flocculation is an advanced process of coagulation carried out through slow stirring. The stirring process can affect coagulation and flocculation. if the stirring speed is very high, then the flock that has been formed can break so that the deposition process does not occur perfectly, while stirring for too long will increase saturation in the coagulation process which can result in a decrease in the ability of the coagulant to reduce wastewater parameters (Husaini, 2018).

In addition, giving the right dose of coagulant can help the process of forming flocs properly so that they can easily settle. However, in this study, the dose of coagulant used was 4.5 mg/l which may not be the right dose to reduce the levels of BOD and TSS in wastewater. So that these factors can affect the resulting sediment which causes BOD and TSS levels do not to meet the applicable quality standards. Therefore, to produce BOD and TSS levels that meet the standards, it is necessary to carry out further processing.

4. Effect of Precipitation Time of Moringa Seed Powder and Tamarind Seed on Reduction of BOD and TSS

Based on the results of statistical tests carried out on variations in the deposition time of Moringa seed powder, obtained a significant value for the 30 minute deposition time of Moringa seed powder on the decrease in BOD of 0.008 <0.05 and a significant value for the 60 minute deposition time of 0.007 < 0.05, then Ha is accepted and Ho rejected. The significant value of 30 minute

deposition time of Moringa seed powder on the decrease in TSS was 0.002 <0.05 and a significant value of 60 minutes was 0.014 < 0.05, then Ha was accepted and Ho was rejected. So that the settling time of 30 minutes and 60 minutes with the use of Moringa seed powder has a significant effect on decreasing BOD and TSS levels.

Similarly, the results of the t-paired sample on variations in the deposition time of tamarind seed powder, obtained a significant value for a 30 minute deposition time for a decrease in BOD of 0.019 <0.05 and a significant value of 60 minutes deposition of 0.018 < 0.05 then Ho is rejected and Ha is accepted. . While the significant value of 30 minutes of deposition time on the decrease in TSS levels was 0.006 <0.05 and 60 minutes of deposition was 0.004 <0.05, then Ho was rejected and Ha was accepted. So that the settling time of 30 and 60 minutes of tamarind seed powder has a significant effect on decreasing BOD and TSS levels.

The results of this study are in line with Julio AW (2017) which states that the longer the deposition time, the lower the levels of BOD and TSS produced. This is because the flock formed can settle perfectly by gravity for a long time. However, if the deposition time is too short, the flock formed cannot settle completely. So that it can affect the resulting BOD and TSS levels.

CONCLUSION

This study concludes that there is a significant effect of settling time of 30 minutes and 60 minutes of moringa seed powder and tamarind seeds as a coagulant on the reduction of BOD and TSS levels of wastewater.

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