International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Potential *Pistia stratiotes* and *Limnocharis flava* as Agent Phytoremediation Coliform Waste

Muhammad Rijal[1], Rosmawati T[2], Surati[3]

[1, 2, 3]Biology Department In IAIN Ambon Indonesia, Dr. Tarmizi Taher Street, Ambon, Indonesian, 97128

Abstract: ***The type of research conducted is a quantitative approach to laboratory experiments that aim to know the ability of P. startiotes and L. flava as bioremediation agents in lowering the value of coliform and gain a potential agent in overcoming impurities coliform. Coliform content in the waste that comes from the Arbes has decreased in all treatments. The largest decline occurred in the treatment T3K4 (using two different types of plants with waste 100%) is 85,41%. Content that is lower than the amount allowed on the quality of water for the needs of the public. Thus, the use of P. stratiotes and L. flava is very potent in lowering the value of coliform MPN and decent used as agent phitoremediation***

Keywords: fitoremediasi, MPN coliform, P. stratiotes, L. flava

1. Introduction

Environmental pollution is a very important issue to be addressed because it can interfere with any activity of the life of living beings, even can cause various diseases that are deadly to humans. The disease can appear in the dirty neighborhood, among others: respiratory tract infections, diarrhea, typhus, dysentery, cholera, etc. Each type of disease can be caused by different pollution sources, such as respiratory infectious diseases caused by the unhealthy air pollution and disease typhus caused by water contaminated by fecal waste. There are also diseases that are caused by the same source of contamination are: diarrhea, typhus, and cholera caused by water contaminated by fecal coliform bacteria [1].

Fecal coliform bacteria are the gram-negative pathogen that is derived from human or animal feces. The presence of fecal coliform bacteria in the water caused by human activities that throw feces into water, for example: making a toilet on the river, drains the stool from the House to the River through the pipes, disposing of animal waste into the River, or disposing of household equipment that is contaminated by feces [2]. The presence of coliform bacteria in the water is a major problem for water pollution, let alone the water is the source of life of the people who lived around a water source or river water is widely used for the activity of human life. One of the rivers that are widely used by the community as the source of life, even as a source of drinking water is a River located in the village of Arbes Kehena Ambon.

Besides used as a source of drinking water, streamlet Arbes also used by the people who live around for bathing, wash, and as septic tank to flow of natural emissions feces to the house through the pipe. The activity in the uncontrollable use Arbes as septic tank natural result in the occurrence of coliform waste water pollution. The fecal coliform causing water is unfit for consumption and used by a community as: a bath or washing clothes. A solution can be done to overcome this pollution problem is to make rules and give sanction to make public toilet in rivers and drainpipe feces into the river.

In addition to making the rules and sanctions to people who dispense the stool into the river, conducted scientific actions such as search also the plant as a potential agent in the remediation sewage pollution at levels of coliform so water could be minimized [3]. Plant used as a biofilterisasi is *Pistia stratiotes* and *Limnocharis flava* that is kind of aquatic herbs floating his life on the water surface with a system of rooting fibers. Both plants are dependent on the conditions of his habitat and availability of nutrients as well as have the ability to reproduce vegetatively or generative in a short time. This plant is widely grown in contaminated areas, such as wetlands, lakes, rivers, and reservoirs with the carbon and nitrogen content were very high [4]. The results of research conducted by Yusuf Guntur indicate that an aquatic plant, as *Eichornia crasipper* and *Hydrilla verticellata* have the ability in accumulating heavy metals of lead on waters and has the ability to degrade concentration in samples of coliform fecal waste taken from residential areas Tallo [5]. To depart from this research, then will try to test the ability of bioremediation by *Pistia startiotes* and *Limnocharis flava* in lowering consentration coliform fecal in the scale of the laboratory, who is tested and this research result as a solution in solving the problem of the river Arbes by the contamination of fecal waste. The aim of this research is to find out the ability *P. startiotes* and *L. flava* as an agent bioremediation in lowering the value of coliform and get agent bioremediation in overcoming coliform potential pollution.

2. Materials and Methods

The type of research conducted is a quantitative approach to laboratory experiments that aim to know the ability of *P. startiotes* and *L. flava* as bioremediation agents in lowering the value of coliform and gain a potential plant agents in overcoming pollution of coliform. This study uses two types of agents are plants of *P. startiotes* and *L. flava* as free variables I and waste concentrations coliform as indicators (100%, 75%, 50%, and 25%) as free variables II. Bound variables in this study was the decreased value of coliform in each treatment indicators are coliform MPN values decreased examined every once a week for 1 month of observation.

The design used in this study was a randomized factorial with the group the total number of observations is 3 x 4 = 12 units of observation. Treatment and observation of the table can be seen as follows:

Table 3.1: Lay Out

Model simulation/concentration coliform waste	K1 (25%)	K2 (50%)	K3 (75%)	K4 (100%)
T1 (*P. stratiotes*)	T1K1	T1K2	T1K3	T1K4
T2 (*L. flava*)	T2K1	T2K2	T2K3	T2K4
T3 (T1 + T2)	T3K1	T3K2	T3K3	T3K4

Table 3.1 shows the total treatment in research namely 12 treatment rooms, each treatment is observed every once a week for a month of observations with previously learned the value of waste MPN are used. The time used in the study is 1 month which started on 21 January to 22 February 2014 and housed in the laboratory SCIENCES IAIN Ambon. Object observed is a decline in the value of coliform in each treatment were tested using the method of MPN tubes 15 series and the results of the study confirmed the MPN. The materials used in this study is *P. startiotes* and *L. flava* as test plant, a waste contain coliform of river Arbes, medium LB (*lactose brooth*), and steriform. The instrument used is the aquarium size 30 cm x 20 cm x 20 cm, aerator, test tubes, durham tube, incubator, the tables confirm MPN, Erlenmeyer flask, micropipet, oven, autoclave, and bottle sampling water.

The first step is collecting waste containing coliform of the Arbes. Location of sampling is on a point that is very prone to waste contaminated by fecal waste exhaust pipe which is around the stool or around the public toilets in the Arbes. The waste samples taken is assumed as the waste with 100% contain coliform concentrations, further diluted in accordance with the sewage treatment concentrations using sterile aquadest. Put waste in the aquarium-sized container 30 cm x 20 cm x 20 cm, each aquarium containing 5 L of waste. The test is placed on the aquarium plants comply with treatment, each containing 500 g aquarium plants. The plant is left exposed to the waste and made observations on coliform debasement of waste each week once during 1 month. Initial measurements carried out for the value of coliform waste on each group's treatment.

3. Results and Discussion

The results showed that there were differences in the ability of lowering the value of waste between coliform *P. stratiotes*, *L. flava*, and combination of both. Decrease the value of the most high coliform MPN found in treatment are combination of *P. stratiotes and L. flava*, then treatment of the *P. stratiotes*, and the least ability to degrade the value of coliform is *L. flava*. Research results can be seen in the following table

Table 4.1: The ability of the plant in lowering the value of MPN coliform

Treatment	MPN Value (MPN/100 ml)					
	Preliminary data	Week to---				The percentage decrease (%)
		1	2	3	4	
T1K1	220	350	280	180	180	18,18
T1K2	350	920	220	220	140	60
T1K3	540	540	350	220	170	68,52
T1K4	**>2.400**	**>2.400**	**1.600**	**1.600**	**920**	**61,67**
T2K1	220	280	170	130	130	40,91
T2K2	350	350	280	280	130	62,86
T2K3	540	920	350	280	220	59,26
T2K4	**>2.400**	**>2.400**	**1.600**	**540**	**540**	**77,5**
T3K1	220	220	180	79	43	80,45
T3K2	350	280	130	140	79	77,43
T3K3	540	280	180	180	140	74,07
T3K4	**>2.400**	**>2.400**	**540**	**540**	**350**	**85,4**

Description:
T1 = *P. stratiotes*
T2 = *L. flava*)
T3 = *P. stratiotes* + *L. flava*)
K1 = Waste coliform with concentration 25%
K2 = Waste coliform with concentration 50%
K3 = Waste coliform with concentration 75%
K4 = Waste coliform with concentration 100%

A table 4.1 indicates the presence of a decrease in value MPN coliform of any treatment who use kind of plant *P. stratiotes*, *L. flava*, and the combination of both. The value of coliform from the wastes coliform to decrease from every treatment, and decrease in the highest in concentration 100 % namely: 61,67 % in treatment plant *P. stratiotes*; 77,5 % in treatment plant *L. flava*; and 85,41 % in treatment combination *P. stratiotes* with *L. flava*. To see a decrease in value MPN on every treatment in every week can be seen from figure a graph here

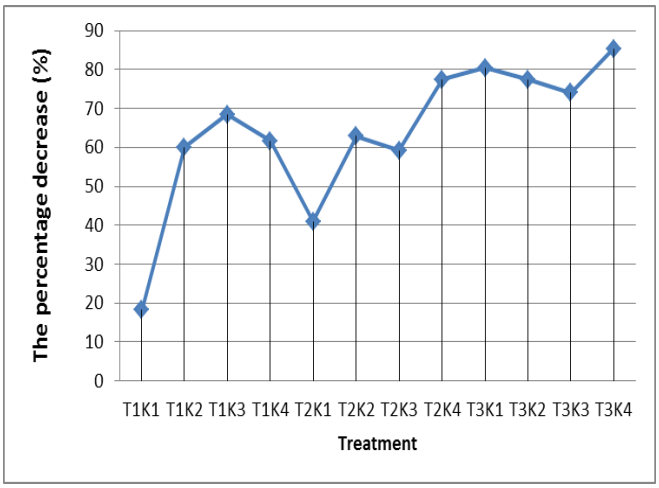

Figure 4.1: The Persentage decreae (%)

Figure 4.1 indicates that the decline of the value of the MPN at each measured treatment every week, though on sunday the first measurements showed an increase in value of the MPN on some preferential treatment, but on the fourth week of measurements showed a significant decline of any treatment. This indicates that *P. stratiotes*, *L. flava* and both have the ability in remediation impurities coliform, making this plant can be used as agents of bioremediation.

The content of coliform on waste derived from the river Arbes decline treatment at all. A decrease in the increases in treatment T3K4 (using two species of plants by concentration of the waste 100 %) is worth 85,41 % or down from 2.4 x 10^4 be 3,5 x 10^3 MPN/100 ml. A decrease in the womb in the process of coliform bioremediation does not

occur directly through a process, the absorption by an aquatic plant but through a process of unravelling and followed up by the process of absorptions [6]. As it known that Coliform is a facultative anaerobe that utilizes microorganisms of organic substances in the water as the medium the place alive. Through a process of filtering, decomposition and absorption of organic substances such as parts of such changes form into a simpler, and the other is absorbed by the water plants. In the circumstances of the case, Coliform cannot utilise the organic ingredients for his survival.

As a result the Coliform experienced critical condition and death, so that the amount be reduced. The raw quality of general-purpose established that the content of the Coliform maximum allowed 2.0 x 10^4 MPN/100 ml. Coliform content thus waste water stream Arbes has been through the process of bioremediation is lower than the amount that is allowed to have been eligible for release into the environment. Effect of content of bioremediation coliform occurred in all treatments, and the largest decrease occurred in the treatment T3K4. Bioremediation results an optimized can lower coliform content of waste water stream Arbes of 2.4 x 10^4 MPN/100 ml into 3,5 x 10^3 MPN/100 ml. The content is lower than the amount allowed on the quality of raw water for the needs of the public. Thus, the river water coliform content Arbes has been through the process of bioremediation, has qualified for the released to the environment. According to Fardiaz and Suriawiria, a waters containing high amounts of coliform can cause the occurrence of interference range for human health [7]. Note that the presence of coliform is indicative of the presence of microbial sextillion another pathogen that comes from the digestive tract. Satisfy the standard of quality for the waste water stream coliform content Arbes pointed out that the effectiveness of bioremediation on this experiment could still be improved, so that the content of coliform can be lowered into smaller. The ability of aquatic plants for filtering, outlining, and absorbs organic material in the waste needs to be balanced with decreased content of bioremediation process prior to coliform. In addition to processing time needs to be increased from 4 weeks to a minimum of 8 weeks, because according to Ahmad, the optimal effect on filtration of contaminants by aquatic plants occur after lasting for more than a month [8].

4. Conclusion

The results showed that the use of aquatic plants (*P. startiotes* and *L. flava*) is very effective for lowering the value of coliform MPN from waste water stream with the highest loss values the Arbes obtained at the treatment plant (a combination *P. stratiotes* and *L. flava* with concentrations of waste 100%) in the 4 week of observation with the percentage decline was 85,41%.

5. Recommendation

The need of advanced research to add to the time of observation that is, till eight weeks so that will be gained by data about a decrease in value MPN coliform waste optimally. In addition, needs to add a variable species of aquatic plant in addition to *P. startiotes* and *L. flava*

References

[1] Sugiharto. 1987. *Dasar-Dasar Pengelolaan Air Limbah*. Penerbit UI Press. Jakarta
[2] Rombaut, R. 2005. *Dairy Microbiology and Starter Cultures*. Laboratory of Food Technology and Engineering. Gent University. Belgium.
[3] Rijal, Muhammad. 2015. The Study of Morfology Apu-Apu (*Pistia stratiotes*) and Kiambang (*Salvinia molesta*). IJPAS, vol 02 issue 04, April 2015, pp 57-64
[4] Purnomo, Edi dan Tribinato, Vebry. 2011. *Adaptasi Tumbuhan Apu Apu (Pistia Stratiotes) Pada Persawahan Desa Bejalen Ambarawa*. Jurusan Biologi Fakultas Matematika Dan Ilmu Pengetahuan Alam Universitas Diponegoro Semarang
[5] Guntur Yusuf. 2008. Bioremediasi Limbah Rumah Tangga dengan Sistem Simulasi Tanaman Air. *Jurnal Bumi Lestari*, vol 8 No. 2, Agustus 2008. Hal 130-144
[6] Atmojo, T. Yuni. Bachtiar, T. Radjasa, Sabdono, A. 2003. The Content of Koprostanol and Coliform Bacteria in aquatic environment of the River, Estuary and Coastal Flooding in the East of the Canal, on the Eastern Monsoon. *Journal of marine science*, vol. 9, no. 1, pp: 40-60
[7] Fardiaz, Srikandi. 1992. *Polusi dan Udara*. Penerbit Kanisius. Yogyakarta
[8] Ahmad, Rukaesih. 2004. *Environmental Chemistry*. Andi Publisher. Yogyakarta.
[9] Decision of the Minister of State for the Environment No. 112 in 2003 about the Raw Domestic Waste Water Quality
[10] Decision of Minister of State for the environment No. 110 in 2003 on guidelines for the determination of Load capacity of water pollution on water resource
[11] Decisions of the Minister of State for the environment No. 115 in 2003 about the determination of the Status of Water Quality Guidelines
[12] Keraf, A. S. 2002. *Environmental Ethics*. Compass. Jakarta
[13] Government Regulation Number 35 year 2011 about the river