

# Analysis of Detergent Waste Absorption Using Water Spinach (*Ipomoea aquatica*)

Syarifa Wahidah Al-Idrus\*<sup>1</sup>, R. Rahmawati<sup>1</sup>, Saprizal Hadisaputra<sup>1</sup>, Hilman Qudratuddarsi<sup>2</sup>

<sup>1</sup>Study Program of Chemistry, Department of Education of Mathematics and Natural Sciences, Universitas Mataram, Jalan Majapahit 62, Mataram, Indonesia.

<sup>2</sup> Mathematics and Science Education Department, Faculty of Education, University of Malaya, University Street, Kuala Lumpur, Malaysia

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**Abstract:** This study aims to determine the absorption of water detergent waste using water spinach (*ipomoea aquatica*). This experimental study used a randomized block design. Water samples were planted with water plants according to the research design. Detergent concentrations were observed using the MBAS (Methylene Blue Active Substance) method. The results showed that water spinach was able to reduce the detergent concentration and improve the concentration of water quality parameters (DO, BOD, and COD). After the treatment of water kangkong, the ability to absorb detergent was seen with a decrease in detergent levels until day 28 of 54.17%. The highest detergent absorption on days 7 and 14.

**Keywords:** absorption; detergent waste; water spinach

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## Introduction

Detergent is a synthetic cleaning agent that is used by industry and households. Detergents contain petrochemical ingredients or other synthetic surfactants. The advantage of detergent is that it has good washing power and is not affected by water hardness. Hard water is water that contains mineral ions such as Ca, Fe, Mg, and Mn. The weakness of detergents is that they contain active substances that are difficult to degrade by microorganisms.

The active substances contained in detergents are surfactants, builders, pH, buffers, and other additive substances (Yangzin, 2008). The largest composition of detergents is surfactants, namely 15% to 40% (Yangxin, 2008). The surfactants in detergents consist of anionic, cationic, and nonionic surfactants. A good surfactant for cleaning is anionic surfactant. The detergent degradation process is difficult to do because in the

detergent molecular structure there are branched chains on the carbon atoms as shown in Figure 1.

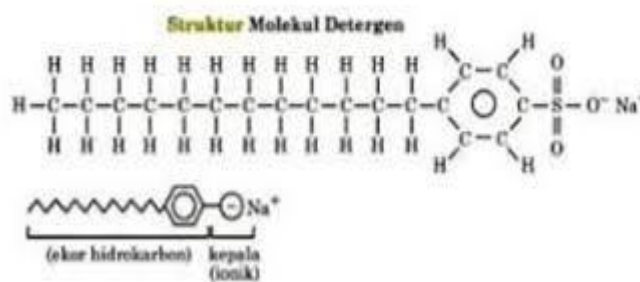


Figure 1. Detergent Molecular Structure  
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According to Suharjono (2010), the community needs detergent as a cleaning agent, and it will produce detergent waste. Detergent waste dissolved in water can inhibit photosynthesis in water and reduce oxygen supply. Phosphate compounds in detergents can cause

eutrophication in water. Eutrophication is a process of enrichment of nutrients and organic matter in water so that phytoplankton and algae bloom in the water. In high amounts it will endanger water quality, low dissolved oxygen, and toxic gases and toxic materials (cyanotoxin) appear (Sugrura et al, 2004; Pattusamy, et al., 2013; Nair, Suka.S. et al., 2015; Wijayanti. 2008). The low amount of dissolved oxygen is an indication of pollution in the waters. So it is necessary to look for an alternative waste treatment that is easy, cheap, and effective in its application.

One of the effective methods is the absorption of waste using water plants. According to Stowell, water plants are able to neutralize certain substances in the waters. Water plants that are often used in the process of absorption of waste are apu wood, genjer, water spinach, water hyacinth and kiambang. Water hyacinth (*Eichornia crassipes*), water spinach (*Ipomoea aquatica*) and apu wood (*Pistia stratiotes*) can accumulate and tolerate toxic metals (Ag, Cd, Cr, Cu, Hg, Ni, Pb, and Zn) (Odjegba, et al, 2004). The plants are used to reduce phosphate and sulfate levels in waters (Hernawati 2005). In this study, water spinach (*ipomoea aquatica*) was used because it is able to absorb waste. According to Lusiani La Tiro (2018) water spinach (*Ipomoea aquatica*) is able to absorb lead (Pb) and copper (Cu) metals in the water. Water spinach is able to absorb cadmium (Cd) from the waters of Resmaya Wulandari (2014). The use of water spinach as a method of absorption of waste is quite effective and efficient because the water spinach plant is very popular on the island of Lombok as a typical plant. This study aims to determine the ability of water spinach plants, which are typical plants on the island of Lombok, to absorb detergent waste in the water.

## Method

This study used a sample from detergent-contaminated waters. The sampling point is a section of the river in the densely populated downstream area with detergent content greater than 0.12 mg/ l, river width 9.0 m, relatively weak river current 0.03 m / s, brown water, and fishy smell. Water samples were taken using a water sampler cammer at a predetermined point. Then analysis of water sample quality parameters (pH, DO, BOD, and COD) and detergent content was carried out.

The plant sample used in this study was water spinach (*Ipomoea aquatica*). The water spinach used is local water spinach that has been taken and acclimated to remove dirt from the roots. The design in this study was a randomized block design (RBD). Group A is the type of plant (K0, K1) and group B is the time / period (H0, H7, H14, H21 and H28). Water samples that have

been analyzed for the initial physics and chemistry parameters were divided into 6 observation tanks for block 1, block 2 and block 3 (K0 repetition (control). K1, observation tub containing water samples and planted with water spinach (*ipomoea aquatica*). The mass of water plants planted in the observation tub is 65 g Block 2 and block 3 are repetitive treatments such as block 1. Every day period (H0, H7, H14, H21, and H28) is observed water quality.

The water quality analysis included physical and chemical analysis (temperature, pH, DO, BOD, COD, and detergent content) before and after treatment. PH measurement using a pH meter. DO analysis (dissolved oxygen) using a DO meter. On the fifth day, BOD (biological oxygen demand) measurements are carried out using a DO meter. The difference between DO5 and DO0 is the BOD value. COD analysis was performed by titration method using potassium dichromate ( $K_2Cr_2O_7$ ) oxidizing agent. Detergent content was tested in the laboratory using the MBAS (Methylene Blue Active Substance) method.

## Result and Discussion

The preliminary data from the water samples show quite high detergent levels. This is due to the people's habit of disposing of their domestic liquid waste directly into the river. According to Rochman (2009) detergent is a domestic liquid waste with the largest volume. The results of initial observations are shown in:

**Table 1.** Sample water quality at the beginning of the study

No	Parameter	Unit	Result	PP Quality Standards No. 82 of 2001 class II
1	Detergen (MBAS)	mg/L	0,12	0,02
2	Dissolved Oxygen (DO)	mg/L	4,3	4
3	Biological Oxygen Demand (BOD)	mg/L	5,6	3
4	Chemical Oxygen Demand (BOD)	mg/L	40,7	25
5	pH	-	6,9	6-9
6	Temperature	°C	28,5	-

**Table 2.** Changes in waterquality parameter values.

No.	Water quality parameters	H0	H7	H14	H21	H28
1.	Detergent	0,12	0,073	0,065	0,057	0,055
2.	DO	4,3	6,8	6,55	5,45	5,2
3.	BOD	5,6	4,3	3,5	2,9	3,8
4.	COD	40,7	36,7	33,8	32,8	31,6

Table 1, shows the water sample quality is above the Class II water level and is categorized as polluted. One of the causes of this pollution is the entry of domestic waste into rivers. Domestic waste mostly contains detergents which are difficult to degrade. Detergent waste will inhibit the solubility of oxygen in water so that DO is low and BOD and COD become high. In addition, the phosphate content in detergents causes the development of freshwater plants, such as algae (which use available oxygen for the decomposition process) so that dissolved oxygen (DO) becomes low (Cohen & Keizer, 2017).

In the observation bath without plants (K0), the detergent content did not decrease significantly. From day 0 (0.12 mg/l) to day 28 (0.115 mg/l). This is because detergents cannot be degraded by microorganisms in water. Detergent levels in water samples planted with water spinach / ipomoea aquatica (K2) decreased. Decrease in detergent levels after treatment is shown in Figure 1.

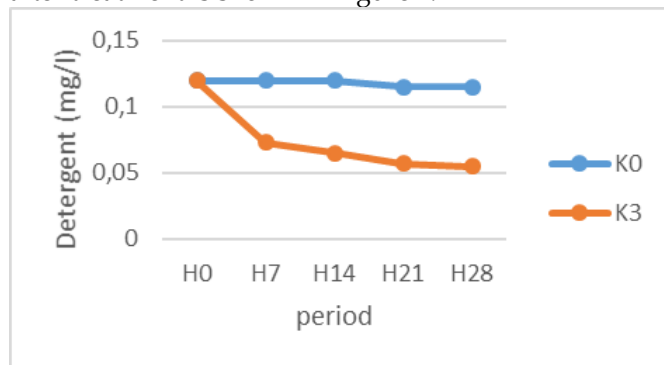


Figure 1. Detergent value at 5 day periods.

Observations were started on the 7th day after planting water spinach in the water sample. Detergent levels decreased significantly from 0.12 mg/L to 0.073 mg/L. This condition is caused by water spinach to absorb chemicals in the waste as nutrients for growth. According to Padmaningrum (2014) in the absorption process using plants, chemical substances contained in waste will be used as nutrients for growth. The absorption process carried out by plants takes three steps (Rosiana, 2007).

Observations on days 14 and 21, detergent experienced a good decrease. This is because water spinach still needs nutrients to grow, as seen by the growth of several kale shoots. On the 28th day of observation, the detergent experienced a small decrease, because the volume of water began to decrease, and the condition of the water did not flow so that plant growth could not be maximized.

Dissolved Oxygen is the concentration of dissolved oxygen in water. Dissolved oxygen in water is obtained through diffusion from air into water, mechanical aeration, and photosynthesis of aquatic

plants. Meanwhile, dissolved oxygen in water can be reduced due to respiration and decay of organic matter at the bottom of the waters (Department of Primary Industries and Resources of South Australia, 2003).

Dissolved oxygen (DO) of water samples in the control did not change significantly. In the treatment with water spinach, there was an increase in DO to 6.8 mg/l on day 7. On day 14 the DO value occurred to be 6.55 mg/l. During the 21st and 28th days, the DO value has decreased as shown in Figure 2. The decline that occurred on days 21 and 28 was due to some of the kale leaves decaying. Rotten leaves will need dissolved oxygen. The pattern of changes in DO values can be seen in Figure 2.

In addition, data retrieval time affect the DO value of the water sample. According to Connell and Miller in Hermawati et al. (2005), that DO is maximal during the day and evening and continues to decrease until just before dawn. The maximum dissolved oxygen content during the day because at that time the plant is actively doing photosynthesis so that a lot of oxygen is produced

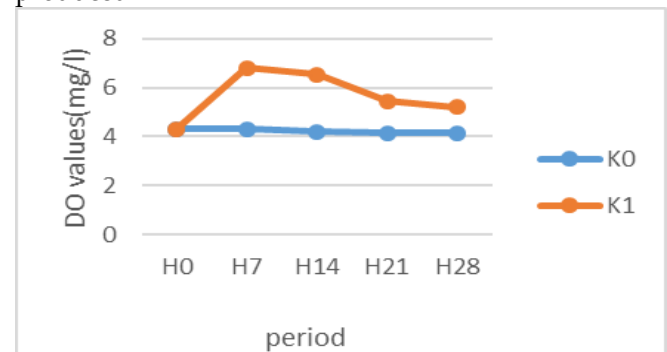


Figure 2. DO values at 5 periods

BOD is the amount of oxygen needed by bacteria to break down dissolved organic substances and some of the organic substances suspended in water. One of the organic substances found in the waters is detergent. BOD in the control water sample did not change. Water samples (K1) decreased BOD on days 7 and 14 to 4.6 mg/l and 3.8 mg/l. The period of day 21, the smallest BOD on the period of day 21 is 1.9 mg/l. then period 28, the BOD value increased slightly to 2.2 mg/l.

A decrease in BOD as an indicator of decreased organic derivate content. Decrease in organic matter derivatives will reduce the use of oxygen in the waters. A decrease in BOD will be proportional to an increase in DO. The pattern of BOD value adjustment is shown in Figure 3.

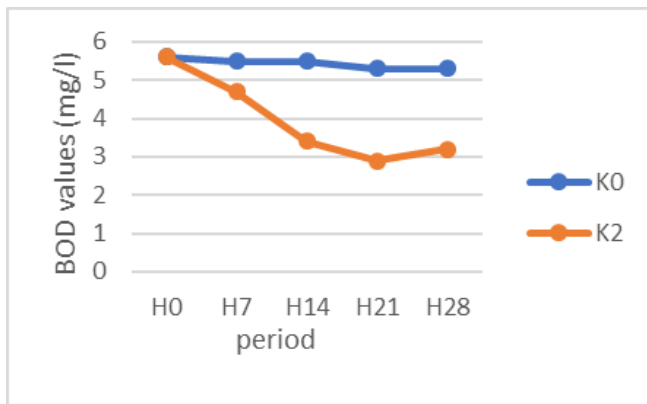


Figure 3. BOD values at 5 day periods.

Chemical Oxygen Demand (COD) is the amount of oxygen in ppm or mg/l needed under special conditions to chemically decompose organic matter, (Devi Ramayanti, 2019). The COD value in the water sample on the first day was quite high, namely 40.7 mg/l, which was above the class II water quality standard. A high COD value indicates that the water is polluted (Dewa and Idrus, 2017). The high COD value indicates the presence of organic substances in large amounts of water samples. Organic substances can convert oxygen into CO<sub>2</sub> and water, resulting in a decrease in oxygen in the waters. An increase in COD in water causes a decrease in dissolved oxygen in the waters (Sami, 2012).

COD of control water sample (K0), did not experience significant changes during the 5 day period of observation. COD of water samples (K1) with water spinach planting treatment, decreased significantly in the 7-day observation period of 36.7 mg/l. on day 14 it continued to decrease to 33.8 mg/l, on day 21 the COD value was 32.8 mg/l and on day 28 it became 31.6 mg/l. a significant decrease is due to water spinach absorbing organic substances in the waters. The pattern of COD reduction in this study can be seen in Figure 4.

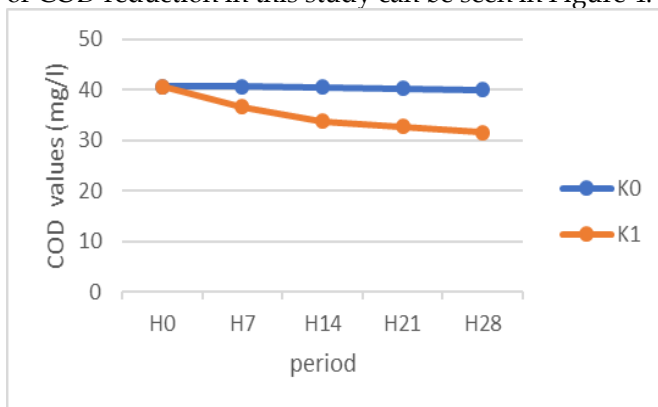


Figure 4. COD values at 5 day periods.

**Table 3.**Percentage of Water Quality Improvement After Treatment (K1)

No.	Water quality parameter	Preliminary data (mg/l)	Data day 28 (mg/l)	% Change
1.	Detergent	0,12	0,055	54,17
2.	DO	4,3	5,2	20,93
3.	BOD	5,6	3,8	32,14
4.	COD	40,7	31,6	22,36

## Conclusion

Water spinach (*Ipomoea aquatica*) is a typical plant on the island of Lombok. Water spinach has the ability to absorb detergent waste in the water. The ability to absorb the best detergent on the 7th and 14th day period. The 7th and 14th period also gave the best results for other parameters (DO, BOD and COD). The results showed that the detergent levels after treatment decreased to 54.17%. DO has increased by 20.93%, BOD and COD have decreased by 32.14% and, respectively, 36%.

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