RESPONSE BIOLOGY EICHORNIA CRASSIPES AGAINST POLLUTION HEAVY METALS MERCURY (HG) FROM THE RIVER WAEAPO IN DISTRICT BURU

by Surati Surati

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RESPONSE BIOLOGY EICHORNIA CRASSIPES AGAINST POLLUTION HEAVY METALS MERCURY (HG) FROM THE RIVER WAEAPO IN DISTRICT BURU

[1]MUHAMMAD RIJAL, [2]SURATI, [3]MOHAMMAD AMIN

Religious Institute State Islamic Ambon, Tarmizi Taher Street, Molucas 97128,
Malang University, Semarang 5 street, East Java 65145[3]
E-mail: [1]rijal_rijal82@yahoo.co.id, [2]qmia7068@gmail.com, [3]rizalamin98@yahoo.co.id

Abstract- Response biology Eichornia crassipes against contaminat heavy metals mercury than 3 station on the Waeapo, district Buru is: long roots downstream is 48,22 cm; middle is 52,02 cm; and upstream is 60,53 cm, dried root of the heavy downstream is 0.2 g; middle is 0.39 g; and upstream is 0,17 g, long petiole downstream is 16.5 cm; middle is 19,63 cm; and upstream is 19,97 cm, heavy dry stalk leaves downstream is 0,94 g; middle is 0,98 g; and upstream is 0.59 g, necrosis leaves on the downstream, middle , and upstream range 50 % -75 %, and heavy dried leaves on the official downstream is 0,19 g; middle is 0,32 g; and upstream is 0.21 g.

Keyword- Disrict Buru, Eichornia, Mercury

I. BACKGROUND

Environmental problems develop into solve the social problems the community with the increasing demand of people 's consumption of products that are exploited from nature. Society development make natural conditions is worrying the more so as to threaten safety and public welfare. Natural devastation natural calamity shall rise of which many deadliest, good treasure and lives, so it needs responses and attention by all levels of society to keep, preserve, anticipate the environmental damage due to mining activity that exploitive and not friendly against nature. Natural conditions being unstable has generated a lot of financial losses for the community, so as to be of the victims of the environmental damage [1]. The past five years in Indonesia, there has been increasing the amount of business in the mining sector traditional gold. Gold mining sites is usually located in the land of personal property that is managed by a group mine workers, and the general public. Since the invention of a gold mine in district Buru (Molucas province), namely at the Botak mountain be a source of income which is very large for miners precious metals. The arrival of gold miners at the site of causing land in Botak mountain turned into a new town, this damaged the residential area, agriculture, and industrial zones in the surrounding region.

The survey shows that gold mining activities done in a traditional manner without planning techniques and use the tools conventional, namely by a system of excavating the soil and make a tunnel or a well that followed the direction quartz veins and done an estimate by applying a technique furrow the ground that has high levels of gold. Mining activities in group into three kinds of work, namely: workers miners quartz veins, processing tufts of rocks and land containing gold with the amalgamation process, and workers demolation. Miners in Botak mountain work without the use of a protective self as with a mask, gloves and work clothes. Ceased that is not processed with good will cause the occurrence of damage and pollution of the environment. As an example, the work of the gold mining business go through traditional gold ore with the amalgamation process that the use of mercury as a medium to bind gold. Mercury having nature of being harmful, its use needs to be monitored so as not to cause negative effects for the environment and human health [2].

That is not the mining processed well will cause a serious problem and that problem of water resources and the quality of water. Gold mine waste disposed of in rivers will cause the occurrence of pollution of the organism to water and living in the rivers. Generally gold mine waste containing heavy metals Hg which constitutes the materials the basis for separating ore gold with of rock or soil that binds [3]. The waters of the Waeapo very important for human life, water is used for a variety of such a drink of needs , bathroom, wash, and cooking. The main problem faced by this constitutes water resources when the quantity of water that can no longer able to fulfill that continues to increase and water quality for household use decrease. The population of the increasing economic growth and who keeps things, stimulated, causing demand for water resources, both the quality and the increasing the availability of quantity more than [4].

Various efforts have been made to reduce the concentration of inorganic substances, organic, organic element and minerals high that was found in the water. One of them is waste water treatment by means of chemical, this is done by adding the certain chemical, and this caused change the nature of. This effort was quite effective in order to minimize the concentration of inorganic substances, organic, organic element and minerals high or kill microorganisms directly, but the usage side synthetic chemical ingredients proven result in a negative

impact on the environment and lead poisoning. The efforts safer to solve the problem the water pollution, one of the early management that can be conducted by using the water hyacinth. The water hyacinth is plants that can neutralize water, Eichornia crassipes having of filtering or permeating a contaminant (fitoremediation) [5].

Fitoremediation serves as a medium waste water filter naturally by plants, so that waste water containing inorganic substances, organic, organic element and minerals will filtration by the mechanisms of the process of occurring in plants the water hyacinth. Aquatic herbs Eichornia crassipes is what we can grow quickly in the tropics. This plant capable of adapting well, so that it can spread very quickly. Eichornia crassipes capable of absorbing various substances contained in the water, dissolved and good and to reduce mercury from compounds in water, then plants is much used in processing fountains of stabilization to stabilize liquid waste disposed on the environment [6].

II. METHOD

The kind of research this is descriptive with the approach the laboratory experiment aimed at ascertaining the womb mercury contained in water and Eichornia crassipes, and knowing response biology herbs Eichornia crassipes due to heavy metal pollution mercury (Hg) Waeapo on the river. Objects in this research is mercury content to water and Eichornia crassipes, as well as biology herbs response due to heavy metal pollution mercury (Hg) Waeapo on the river. A water sample and Eichornia crassipes took out of the different Waeapo the location by using the method which is purposive the sampling method of determining the location of on purpose. A water sample collection is done at the station, the upper part of which is fixed the middle, and downstream by means of which a vessel is not affected by the water is 350 ml plastic bottle attached [7].

Volatile metal is metallic mercury , in preparation of the analysis so that the sample is not allowed to dried beforehand, weighed first sample was later incorporated in the size of 100 ml of test tube equipped with a condenser cooling watered by running streams. Added 10 ml of concentrated HNO_3 then inserted in blocks digesti and heated up to 120 ^{0}C. A condenser plugged then by running streams that flows serves as a coolant, of steam issuing a tube going back to condense right inside a tube. Digesti be implemented for 4 hours and cooled, then will be with sytem the flame (flameless), use of a machine automatic absorption spectrometer (AAS) to a kind of brand DB-G [8]. Observations on the organ damage roots Eichornia crassipes covering: long roots, heavy dried root, titled the root of the ratio, necrosis, heavy dry leaves, long stem, heavy and dry stalks. The result of reckoning data heavy metal content (Hg) on roots, stem and leaf Eichornia crassipes will be analyzed by test different, if was obtained real difference (significant) then continued with BNJ with test level of 5 %.

Result

1. Heavy metals mercury in samples of river water

The analysis of the waters of the sample Waeapo taken from 3 station, shows that there is the content of heavy metals mercury

aTable 4.1. Average the content of heavy metals mercury detected in water

Raw EPA standard (ppm)	**Station**	The average heavy trace of any metal mercury (Hg) in of water from any station (ppm)
		River Waeapo
0,001 ppm	I	3,16 a
0,001 ppm	II	4,04 b
0,001 ppm	III	2,51 b
BNJ 5% = 0,87		

Information: figure that followed with the same letter not markedly dissimilar according to the BNJ distance 5 %

Table 4.1 explained that the average content heavy metals mercury highest station obtained from II (middle) namely 4,04 ppm. Content while the average heavy metals mercury lowest obtained from III (downstream) namely 2,51 ppm. Limit mercury levels are allowed to be in waters mg namely 0,001 mg/L set by DEP. Kes. R.I. No.01/1975.

2. Heavy metals mercury on the organ roots of Eichornia crassipes

The analysis of sample obtained from the river Waeapo separated based on an organ (the root of, the petiole, and leaves) away from 3 station, shows that there is the content of heavy metals mercury .

Table 4.2 the average the content of heavy metals mercury in the root of Eichornia crassipes

Station	The average heavy metal content of mercury in the root of every station (ppm)
	River Waeapo
I	1,093 a
II	1,108 a
III	0,728 a
BNJ 5% = 0,261	

Information: figure that followed with the same letter not markedly dissimilar according to the BNJ distance 5 %

Table 4.2 shows there is no difference the womb heavy metals mercury in the root of Eichornia crassipes in different stations. The content of heavy metals mercury is highest on the roots from the station II (middle) with an average 1,108 ppm , then trace of any metal mercury the lowest on the roots from the station III (upstream) with an average 0,728 ppm

3. Heavy metals mercury on the organ petiole of Eichornia crassipes

Table 4.3 the average the content of heavy metals mercury in the petiole of Eichornia crassipes

Station	The average heavy metal content of mercury in the petiole of every station (ppm)
	River Waeapo
I	3,36 a
II	4,03 a
III	1,72 a
BNJ 5% = 1,16	

Information: figure that followed with the same letter not markedly dissimilar according to the BNJ distance 5 %

Table 4.3 Indicated no difference heavy metal content of mercury in the petiole Eichornia crassipes of three different stations. The content of heavy metals mercury is highest on a stalk leaves from the station II (middle) with an average 4,03 ppm, then trace of any metal mercury the lowest on a stalk leaves from the station III (downstream) with an average 2,36 ppm

4. Heavy metals mercury on the organ leaf of Eichornia crassipes

Table 4.4 the average the content of heavy metals mercury in the leaf of Eichornia crassipes

Station	The average heavy metal content of mercury in the leaf of every station (ppm)
	River Waeapo
I	0,748 a
II	0,843 a
III	0,365 a
BNJ 5% = 2,710	

Information: figure that followed with the same letter not markedly dissimilar according to the BNJ distance 5 %

Table 4.4 Indicated no difference the womb heavy metals mercury in the leaves of Eichornia crassipes of three different stations. The content of heavy metals mercury is highest on the leaves from the station II with an average 0,843 ppm, and of the womb heavy metals mercury the lowest was in the leaves from the station III with an average 0,365 ppm.

5. Long roots of Eichornia crassipes

The results of data analysis using analysis variansi (ANAVA) show $f_{count} > f_{tabel}$ 0.05 to long roots Eichornia crassipes derived from river Waeapo then can conclude that there is the influence of metallic mercury against long roots.The results of data analysis whole can be seen in appendix 3.Next test results further BNJ 5 % presented in table.4.5.

Table 4.5 .The average length of roots Eichornia crassipes in each station Waeapo river

Station	The average length of root (cm) of each station
	River Waeapo
I	48,22 a
II	52,02 a
III	60,53 b
BNJ 5% = 6,94	

Information: figure that followed with the same letter not markedly dissimilar according to the BNJ distance 5 %

Table 4.5 Exhibiting differences the average length of roots Eichornia crassipes from the station I , II, and III .The average length of highest roots on roots from the station iii even up to 60,53 cm , while the shortest derived from the station i with the average length of 48 , 22 cm .

6. Dry weight roots of Eichornia crassipes

The results of data analysis using variansi analysis (ANAVA) shows $f_{count} > f_{tabel}$ 0.05 to Eichornia crassipes root dry weight that comes from the Waeapo then it can be inferred that there is Mercury metal influence against the length of the root. Further test results further BNJ 5% served on tables. 4.6

Table 4.6 .The average weight of the dried roots Eichornia crassipes Waeapo station on each of the river

Station	The average weight of dry (g) of each station
	River Waeapo
I	0,2 a
II	0,39 a
III	0,17 a
BNJ 5% = 0,082	

Information: figure that followed with the same letter not markedly dissimilar according to the BNJ distance 5 %

Table 4.6 It can be seen that the average weight the dried root of the highest found in plants Eichornia crassipes from the station II (middle) with an average 0.39 g the average frequency of the dried root of the heavy low from the station III with an average 0,17 g.

7. Length of Petiole Eichornia crassipes

he results of data analysis using analysis varians (ANAVA) show $f_{count} > f_{tabel}$ 0.05 to long petiole Eichornia crassipes derived from river Waeapo then can conclude that there is the influence of metallic mercury against long leaf stalks. Next test results further BNJ 5 % presented in table 4.8.

Table 4.8 .The average length of a petiole Eichornia crassipes on each station

Stasiun	The average length of a petiole *Eichornia crassipes* (cm) on each station
	River Waeapo
I	16,5 a
II	19,63 ab
III	19,97 b
BNJ 5 % = 2,04	

Information: figure that followed with the same letter not markedly dissimilar according to the BNJ distance 5 %

Table 4.8 Be seen that long stalk the longest leaves from the station III by the average length of is 19,97 cm, while the lengths the stalk from the station shortest I with the average length of is 16.5 cm.

8. Weight dry stalk leaves Eichornia crassipes leaves

The results of data analysis using analysis varians (ANAVA) show $f_{count} > f_{tabel}$ 0.05 to weigh dry stalk leaves Eichornia crassipes that derived from the Waeapo then it can be concluded that there is the influence of metallic mercury heavy on dry stalk Eichornia crassipes leaves. Next testing shows BNJ said 5 % presented in table 4.9.

Table 4.9 .The average weight dry stalk leaves Eichornia crassipes on each station

Station	The average weight of each dry stalk leaves *Eichornia crassipes* (g) on each station
	River Waeapo
I	0,94 a
II	0,98 a
III	0,59 a
BNJ 5% = 0,072	

Information: figure that followed with the same letter not markedly dissimilar according to the BNJ distance 5 %

Table 4.9 Heavy show dry stalk leaves largest Eichornia crassipes from the station II and average weight is 0,98 g while the lowest is derived from the station III and average weight is 0.59 g.

9. Necrosis on leaves Eichornia crassipes

The analysis of the data shows that the level of necrosis on each station on the Waeapo markedly dissimilar in each station .This is due to the level of necrosis in a river Waeapo almost entirely on the score 1 and 2, where the rate at around 75 % necrosis and 50 % of the surface of leaf.

10. Weight of the dried leaves Eichornia crassipes

The results of data analysis using analysis (ANAVA) show $f_{count} > f_{tabel}$ 0.05 to heavy on the parameter of dried leaves.The average heavy dried leaves presented in table 4.11

Table 4.11. The average weight of the dried leaves Eichornia crassipes on each station

Station	The average weight dried leaves *Eichornia crassipes* (g) on each station
	River Waeapo
I	0,19 a
II	0,32 b
III	0,21 b
BNJ 5% = 0,072	

Information: figure that followed with the same letter not markedly dissimilar according to the BNJ distance 5 %

Table 4.11 Indicate an average weight dried leaves Eichornia crassipes shown at the second station reached 0,32 g and lowest in the first station by an average 0,19 g.

DISCUSSION

Gold mine waste, being disposed of in a body of a river without being processed first, accumulating and will affect the presence of metal mercury found in waters. Contaminated water show certain traits as turbid or colored smelling, pH, containing various dangerous chemical substances like heavy metals, or containing microorganisms that can interfere with water users. Water pollution can occurs either on land waters (of a river and lake) or in the waters of the sea. Waters land damage can be caused by industrial waste, households, and deforestation. The mainers gold often disposing of sewage dangerous and poisonous directly to the waters without through the unit waste processing first [8].

Waste this containing mercury. This substance is poisonous so destructive in ecosystems life aquatic and harmful to animal or man who drink water from the area. The waters of the transporting particles mud in the form of suspension, when particles reached downstream and mingled with sea water, mud will particles form particles that is larger and settles on the basis of waters. Although been an increase in a source of heavy metal, but the concentration in water can change at any time. It is, due to the various processes experienced by those compounds in water waters [9]. The results of research show to have a river Waeapo the heavy metal roots mercury in the organ, this is because the river Waeapo used as a the disposal of sewage gold mine. Heavy metals mercury enter into an organ roots Eichornia crassipes due to the diffusion of water into the cell roots. Water transported toward the headline a root with xylem due to pass through the tissue transprasi pull. There are two ways the absorption of ions into the roots of plants [10].

1. The flow of mass, ions in water moving toward roots potential gradient caused by transpiration
2. Diffusion, produced by the concentration of ions adoption on the surface of the root

Heavy metal can association in higher plants. Heavy metal not yet known its functions in metabolism of plants include mercury. All the heavy metal could potentially polluting plants .The mechanism of metal pollution in biochemistry in plants which is divided into six processes are: 1. The metal disturb the function of an enzyme; 2. The metal as anti a metabolite; 3. The metal form layers sediment stable with a metabolite essential; 4. Metal as catalysts in the decomposition of a metabolite essential; 5. Metal change the cell membrane permeability; and 6 Metal replace the structure and a chemical element most important in the cell [11].

The heavy metals mercury is active very easily absorbed and transferred to the roots of plants.

Heavy metal would normally distributed in the plant by the roots; to the greatest the stalk of a leaf and leaves. Distribution of heavy metals into the plants is one form of defense [12]. Heavy metals mercury enter into the petiole Eichornia crassipes due to the diffusion of water into the root. Water transported to the petiole through a network of xylem. A heavy toxic, the heavy metals mercury with the highest growth of harm to human health [13]. The result of this research also shows the heavy metals mercury on the stalk of a leaf of higher compared to the root and leaf. The high trace of any metal heavily on part certain herbs shows there is an effort to localize toxic matter who enters into the body toward the more immune to the influence of toxic, so it does not affect a body part that is vulnerable to toxic material [14]. Localization metal on a network prevent of its toxicity its metal against cells, they have detocsification mechanism, for example by heaping metal in an organ in certain [15]. The presence of metal mercury in heavy station I allegedly came from the wastes industrial park that somewhere in the station. Any industrial use of raw material and supporting materials different in the process of production. The use of chemicals dangerous, so that waste produced a concern that contains elements of equal to my material. The industries industry of waste a body of aquatic or a river without passed management process first. If the water used to flow the rice fields, and the land will happen of stockpiling heavy metal. To same with absorption of organic element by the plant, those heavy metal will also be absorbed in plants, and will eventually accumulates in the tissues of plants [16].

Heavy metals mercury in station III river Waeapo it is allegedly adjacent to residential areas which are densely populated and the main highway transportation Waeapo and Waelata, densely populated residential area with the potential to produce household wastes large in heavy metal transfer to the waters, as the majority of the population will dispose of the waste into the river. In addition corrosion water channel pipe and household equipment also contributed heavy metal supply to the waters .The growth of plants impeded because of the process of photosynthesis leaf tissue resulting from damage. This is supported by research exhibiting that air pollution caused a decline in the klorofil-a and klorofil-b plants. This fall is caused a contaminant destructive polisade tissue and sponge is a network that many contain chloroplasts. A fissure stomata in length about 10 μm and width between 2 –7 μm. Then particles are entered in the leaves of the passing a fissure stomata and dwell at leaf tissue and piled up at between the aperture of the cells tissue/polisade a fence and or tissue of the sponge [17].

Plants were able to tainted heavy metal through the absorption of the root of the ground or through stomata leaves from the air. Absorption on the leaves occurred because mercury particles in air enters into the process leaves through passive the absorption of [18]. The entry of mercury particles into the tissues of the leaves is highly influenced by the size and the sum of stoma. Great size the more stoma the more large absorption enter into a leaf. While the mechanism the entry into leaf tissue place in a passive, but it also supported by parts being is in plants and leaves constituting the most rich in the chemical elements. Dried leaves of the heavy Eichornia crassipes that does not vary significant at any location, shows that there is a certain mechanism of the plant, so that it can maintain biomass plants although the environment unfavorable the growth of [19].

CONCLUSION

1. The average heavy metal content mercury on water obtained from 3 station on the Waepon, district Buru in Molucas is: downstream is 3.16 ppm; middle is 4,04 ppm; and upstream is 2,51 ppm.
2. The average trace of any metal weight on any organ Eichornia crassipes obtained from 3 station on the Waeapo, district Buru is: root at downstream is 1,093 ppm; middle is 1,108 ppm; and upstream is 0,728 ppm, petiole on the downstream is 3,36 ppm; middle is 4,03 ppm; and upstream is 2.23 ppm, and leaves on the downstream is 0,748 ppm; middle is 0,843 ppm; and upstream is 0,365 ppm
3. Response biology Eichornia crassipes against contaminat heavy metals mercury than 3 station on the Waeapo, district Buru is: long roots downstream is 48,22 cm; middle is 52,02 cm; and upstream is 60,53 cm, dried root of the heavy downstream is 0.2 g; middle is 0.39 g; and upstream is 0,17 g, long petiole downstream is 16.5 cm; middle is 19,63 cm; and upstream is 19,97 cm, heavy dry stalk leaves downstream is 0,94 g; middle is 0,98 g; and upstream is 0.59 g, necrosis leaves on the downstream, middle , and upstream range 50 % -75 %, and heavy dried leaves on the official downstream is 0,19 g; middle is 0,32 g; and upstream is 0.21 g.

SUGGESTION

1. There should have been more research on the womb mercury on fish or other water of the organism which constitutes the materials public consumption
2. The water hyacinth herbs can be utilized as biomonitoring and bioremediation heavy metals mercury
3. Should be created the same study in another river adjacent to a river Waeapo

REFRENCES

[1]. Said Fais Assagaf, Penambangan Emas Berkarakter Kerakyatan dan Berprespektif Ekologis di Gunung Botak (GB) Kabupaten Buru, (Namlea: Universitas Iqra Buru, 2012). hlm. 1

[2]. Loka Karya Praktek Penambangan Emas Sekala Kecil (PESK) Bebas Merkuri, Mataram Lombok Garden Hotel, 9-11 Februari 2012, hlm. 1.
[3]. Nikie Astorina Yunita Demianti, Hubungan Paparan Merkuri (Hg) Dengan Ganguan Fungsi Hati Pada Pekerja Tambang Emas Di Desa Jendi Kecamatan Selogari Kabupaten Wonogiri, (Semarang; Program Pasca Sarjana Universitas Diponegoro, 2013), hlm. 1.
[4]. Rambang Hendra Siswoyo, Eichornia crassipes (Eichhornia crassipes) dan Kiapu (Pistia Stratiotes) sebagai Biofilter PB dan Hg pada Perairan Tercemar, Jurnal Ilmiah, (Medan: Universitas Dharmawangsa, 2010), hlm. 16.
[5]. Direktur Jenderal WHO, Planet Kita, Kesehatan Kita Laporan Komisi WHO Mengenai Kesehatan dan Lingkung, (Cet; 1, Yogyakarta: Gadjah Mada University Press, 2001). hlm. 147-148.
[6]. Lilik Triyanto,SP, Pemafaatan Eichornia crassipes sebagai Biofilter Alami pada Pre-Treatment Pengelolaan Kualitas Air, Karya Ilmiah, Nusa Tenggara Barat, 2010. hlm.
[7]. Hanni Daylistio Rahmaningsih, Kajian Penggunaan Eichornia crassipes Pada Penurunan Senyawa Nitrogen Efulen Pengelolaan Limbah Cair PT. Capsugel Indonesia (Skripsi), Institut Pertanian Bogor, 2006. hlm 14.
[8]. Darmono, Logam Dalam Sistem Biologi Makhluk Hidup, Jakarta: Universitas Indonesia, 1995), hlm. 125-126.
[9]. Totok Sutrisno, Teknologi Penyediaan Air Bersih, (Jakarta: Rineka Cipta, 2010). hlm. 50.
[10]. Rini Yeni Susanti, Analisis Kandungan Logam Berat Merkuri (Hg), Timbal (Pb) Dan Kadmium (Cd) Pada Ikan Baung (Hemiarius Stornii) Yang Diperoleh Dari Sungai Kahayan Kalimantan Tengah,(Jurnal), (Semarang: Fakultas Farmasi Universitas Wahid Hasyim, 2008). hlm. 33.
[11]. Yudha Arie Wibowo, Ancaman Dan Pengendalian Pencemaran Logam Berat Di Kawasan Estuaria, (Jurnal), (Suraba Program Studi Oseanografi Universitas Hang Tuahya, 2009. hlm. 3.
[12]. Rambang Hendra Siswoyo, Eichornia crassipes (Eichhornia crassipes) dan Kiapu (Pistia Stratiotes) sebagai Biofilter PB dan Hg pada Perairan Tercemar, Jurnal Ilmiah, (Medan: Universitas Dharmawangsa, 2010), hlm. 43.
[13]. Susi Nurul Khalifah, Studi Keseimbangan Adsopsi Merkuri (II) pada Biomasa Daun Enceng Gondok (Eichhornia crassipes) yang Di Immobilisasi pada Matriks Polisilikat (Skipsi), (Malang: Universitas Islam Negeri Malang, 2007), hlm. 33.
[14]. Noviana Khalidiyah, Respon Biologis Tumbuhan Eichornia crassipes (Eichhornia crassipes) sebagai Biomonitoring Pencemaran Logam Berat Cd dan Pb pada Sungai Pembuangan Lumpur Lapindo, Kecamatan Porong Kabupaten Sidoarjo(Skripsi), (Malang: Universitas Islam Negeri Malang, 2010), hlm. 83.
[15]. Rambang Hendra Siswoyo, Eichornia crassipes (Eichhornia crassipes) dan Kiapu (Pistia Stratiotes) sebagai Biofilter Pb dan Hg pada Perairan Tercemar, Jurnal Ilmiah, (Medan: Universitas Dharmawangsa, 2010), hlm. 54.
[16]. Hanni Daylistio Rahmaningsih, Kajian Penggunaan Eichornia crassipes Pada Penurunan Senyawa Nitrogen Efulen Pengelolaan Limbah Cair PT. Caapsugel Indonesia (Skripsi), Institut Pertanian Bogor, 2006. hlm. 34.
[17]. Hanni Daylistio Rahmaningsih, Kajian Penggunaan Eichornia crassipes Pada Penurunan Senyawa Nitrogen Efulen Pengelolaan Limbah Cair PT. Caapsugel Indonesia (Skripsi), Institut Pertanian Bogor, 2006. hlm. 45.
[18]. Srimulyani E.S, Anotomi Tumbuhan, (Yogyakarta: Kanisius, 2006), hlm. 223.
[19]. Noviana Khalidiyah, Respon Biologis Tumbuhan Eichornia crassipes (Eichhornia crassipes) sebagai Biomonitoring Pencemaran Logam Berat Cd dan Pb pada Sungai Pembuangan Lumpur Lapindo, Kecamatan Porong Kabupaten Sidoarjo(Skripsi), (Malang: Universitas Islam Negeri Malang, 2010), hlm. 67.

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