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Study on The Use of Genjer Plant (*Limnocharis flava*) as Adsorbent of Copper (Cu^{2+}), Lead (Pb^{2+}), and Zinc (Zn^{2+}) Metal Ion in Water

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Abstract. The use of Genjer (*Limnocharis flava*) as an adsorbent for ions of Copper (Cu^{2+}), Lead (Pb^{2+}), and Zinc (Zn^{2+}) contents in the water has been studied. Firstly, Genjer powder was cut to pieces, dried, blended, and activated with HCl 10% for 24 hours. The two grams powder of Genjer was activated by HCl 10% added into each 100 mL copper (Cu^{2+}) standard solution, lead (Pb^{2+}) standard solution, and zinc (Zn^{2+}) standard solution with a concentration 20 mg/L. Stirred for 24 hours, filtered and measured concentrations ions of copper (Cu^{2+}), lead (Pb^{2+}), and zinc (Zn^{2+}) using an Atomic Absorption Spectrophotometer (AAS). The result of the research showed that the powder of Genjer (*Limnocharis flava*) that has been activated by HCl 10% can absorb copper (Cu^{2+}) 96.083%; lead (Pb^{2+}) 99.33% and zinc (Zn^{2+}) 96.28%.

Keywords: Adsorbent, Metal, Genjer Powder, and Synthetic Solution

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1 Introduction

Water is an essential ingredient in life, therefore no living thing on earth can live without water. More than 75% of plant cells contain water and 67% of animal cells contain water. If the water content is reduced, for example in humans, dehydration (lack of body fluids) will occur which if not handled properly will result in vomiting and death (Suriawiria, U. 2005).

The current problem is that the quality of water, especially for various needs in Indonesia, is still a concern. Pollutants can be in the form of biological contaminants such as bacteria and chemical contaminants such as pesticides and dissolved metals in water. These metal contaminants can come from nature naturally or from factory waste that enters water bodies. These metals include Hg, Cd, Pb, As, Zn, Cu, Al, Fe, and others. These metals are used for industry and then many are wasted in nature as factory waste, especially in river bodies. When

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Journal of Chemical Natural Resources Vol. 02, No. 01, 2020 | 8 – 13

these metals enter the body of living things, especially humans, they will cause various diseases such as chronic poisoning, deficiency diseases, cancer, and even death (Darmono, 1995).

Cu metal is widely used in factories that produce electrical equipment, glass, and dyes which are usually mixed with other metals as alloys where the remnants of this metal can enter river bodies as a source of Cu metal pollution. In humans, the effect of Cu metal poisoning is the occurrence of disturbances in the upper respiratory tract. Pb metal is widely used for the production of batteries in motor vehicles and additives such as TEL (Tetra Ethyl Lead) or TML (Tetra Methyl Lead). If water contaminated with Pb is consumed, it can lead to Pb poisoning, which in excessive doses can cause death in aquatic biota and poisoning in humans. Zn metal is widely used in metal coatings, dyestuffs for paints, lamps, glass, pesticides, and metal casting. Zn metal dissolved in water in the form of Zn^{2+} ions when consumed by humans can result in decreased taste when tasting food, delays in wound healing, growth slow, and low birth weight babies born to mothers who are contaminated with zinc in excess amounts (Darmono, 1995).

Due to the unfavorable consequences of the presence of these metals in the human body, it is necessary to make an effort to reduce the levels of these metals in water. To reduce the levels of these metals, metal adsorbents can be made based on natural materials, namely by using several types of aquatic plants which are known to absorb metals. These plants include water hyacinth, kiambang, genjer and water spinach (Nisma, F. 2008).

Genjer (*Limnocharis flava*) is an aquatic plant that usually grows in rice fields. Genjer is often used by the community as a side dish because it tastes good and contains several types of nutrients needed by the body, but in excess amounts, this plant is often considered a weed that interferes with plants so a lot of it is just wasted. Based on several previous studies, it is known that Genjer (*Limnocharis flava*) alive can absorb metals in water, therefore this plant is suitable as an adsorbent for the absorption of metals dissolved in water (Nisma, F. 2008). This research was conducted to explore the possibility of using genjer plant as an adsorbent of copper (Cu^{2+}), lead (Pb^{2+}), and zinc (Zn^{2+}) ions contained in water.

2 Materials and Methods

2.1 Equipments

In this study, a Shimadzu AA-7000F Atomic Absorption Spectrophotometer (SSA), measuring flask, volume pipette, beaker glass, Erlenmeyer, analytical balance, filter paper, oven, desiccator, universal indicator, blender, stirring rod, aluminum foil, and measuring cup.

2.2 Materials

The materials used include Genjer rod, 10% HCl, HNO_3(p) (p.a Merck), $CuSO_4.5H_2O$ (p.a Merck), $Pb(NO_3)_2$ (p.a Merck), $ZnSO_4.7H_2O$ (p.a Merck) and distilled water.

Journal of Chemical Natural Resources Vol. 02, No. 01, 2020 | 8 – 13

2.3 Preparation of the Genjer sample

Take the genjer stems on the 3rd, 4th, 5th, and 6th segments. The leaves are removed and then washed. The genjer stems are then sliced and dried in the sun to dry (brown) with a moisture content of about 10% in approximately 1 week. After drying, the genjer stems are then ground with a blender until smooth.

2.4 Activation of the Genjer sample

Take 100 g of dry genjer powder and put it into a 1000 mL glass beaker, then add 10% HCl while stirring until all the dry genjer powder is submerged. The beaker glass was covered with aluminum foil and allowed to stand for 24 hours. After soaking, the genjer sample was washed with distilled water until the last washing water was neutral. The samples were then dried in an oven at 110oC for 5 hours. Then cooled in a desiccator.

2.5 Preparation of standard solution of Cu^{2+}, $Pb^{2+,}$ and Zn^{2+} for calibration curves

The absorbance of the blank solution was measured using an Atomic Absorption Spectrophotometer at a specific 324.8 nm for Cu^{2+}; 283.3 nm for Pb^{2+} and 213.9 nm for Zn^{2+}. The treatment was carried out three times and the same was done for the standard series solution 0.5; 1.0; 2.0; 3.0 and 4.0 mg/L.

2.6 Absorption and Measurement of Cu^{2+}, Pb^{2+} and Zn^{2+} Concentrations in Water by Active Genjer Powder Adsorbents

A total of 100 mL of Cu^{2+} 20 mg/L was put into a 250 mL glass beaker, then 2 g of active genjer powder which had been activated by 10% HCl was added so that all genjer powder was submerged. Then the beaker was covered with aluminum foil and stirred with a magnetic stirrer for 24 hours. After 24 hours, the sample was then filtered through filter paper. The filtrate was acidified to pH 3.50 with HNO_3(p). The measurement of Cu^{2+} absorbance was carried out with an Atomic Absorption Spectrophotometer at a specific 324.8 nm for a synthetic solution of 20 mg/L and a standard solution. The treatment was carried out three times for each sample. The same treatment was repeated for Pb^{2+} ions with a specific of 283.3 nm and Zn^{2+} with a specific of 213.9 nm.

3 RESULT AND DISCUSSION

The results of the measurement of the absorbance of the standard Cu^{2+} series solution in table 4.1 are plotted against the concentration so that a calibration curve is obtained in the form of a linear line. The regression line equation for this calibration curve can be derived using the Least Square method to obtain the concentrations of Cu^{2+}, $Pb^{2+,}$ and Zn^{2+} ions. The decreasing of the concentration of metal ions contained in the water after being adsorbed by the adsorbent of the genjer rod powder is measured by following the formula below.

Journal of Chemical Natural Resources Vol. 02, No. 01, 2020 | 8 – 13

$$\frac{[metal\ ion]initial - [metal\ ion]final}{[metal\ ion]initial}\ x\ 100\%$$

Tabel 1, 2, and 3 show the data and calibration curves of Cu^{2+}, $Pb^{2+,}$ and Zn^{2+} ions, respectively. From the results of research that has been carried out, it is known that genjer rod powder which has been activated with 10% HCl can absorb metal ions optimally.

Table 1. the absorbance of the standard solution series of Cu^{2+}

No.	Concentration (mg/L)	Absorbance
1.	0.0	0.0000
2.	0.5	0.0901
3.	1.0	0.1787
4.	2.0	0.3458
5.	3.0	0.5019
6.	4.0	0.6500

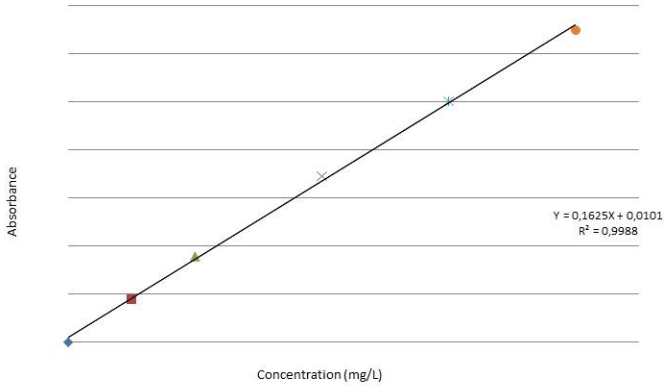

Figure 1. the absorbance of the standard solution series of Cu^{2+}

Table 2. The absorbance of the standard solution series of Pb^{2+}

No.	Concentration (mg/L)	Absorbance
1.	0.0	0.0000
2.	0.5	0.0133
3.	1.0	0.0262
4.	2.0	0.0517
5.	3.0	0.0760
6.	4.0	0.0991

Journal of Chemical Natural Resources Vol. 02, No. 01, 2020 | 8 – 13

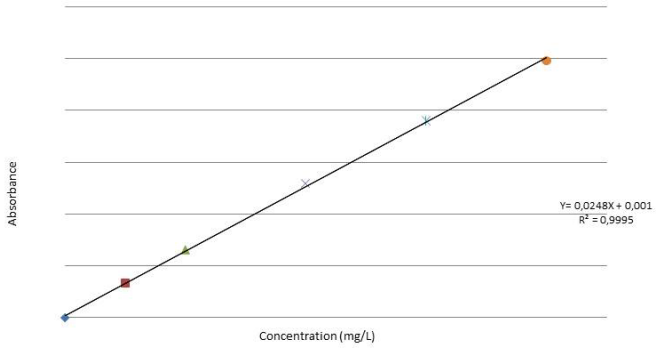

Figure 2. the absorbance of the standard solution series of Pb^{2+}

Table 3. The absorbance of the standard solution series of Zn^{2+}

No.	Concentration (mg/L)	Absorbance
1.	0.0	0.0000
2.	0.2	0.1478
3.	0.4	0.2585
4.	0.6	0.3639
5.	0.8	0.4782
6.	1.0	0.5732

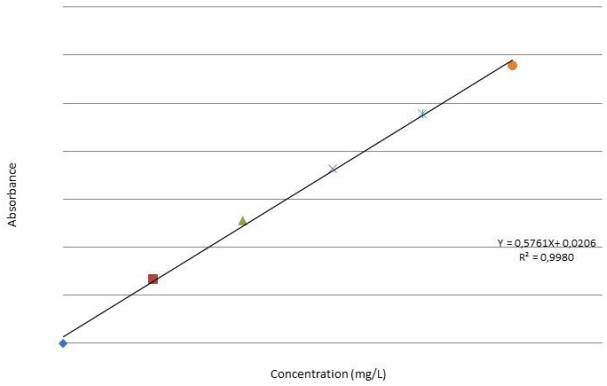

Figure 3. The absorbance of the standard solution series of Pb^{2+}

Table 4. Absorption data of the active genjer powder adsorbent which activated with 10% HCl against Cu^{2+}, Pb^{2+} and Zn^{2+} ions

No.	Ion	HCl 10%
1	Cu^{2+}	96,08%
2	Pb^{2+}	99,33%
3	Zn^{2+}	96,28%

Journal of Chemical Natural Resources Vol. 02, No. 01, 2020 | 8 – 13

4 Conclusion

From the research that has been carried out, it was concluded that the activation of genjer stem powder (*Limnocharis flava*) with 10% HCl was the optimum activation and the active genjer powder (*Limnocharis flava*) obtained was able to reduce the Cu^{2+} concentration 96.08%; Pb^{2+} 99.33%, and Zn^{2+} 96.28%.

References

Ahmad, R. 2004. *Kimia Lingkungan*. Jakarta: Penerbit Andi.

Darmono. 1994. *Logam Dalam Sistem Biologi Makhluk Hidup*. Jakarta: UI Press.

Darmono. 2001. *Lingkungan Hidup dan Pencemaran Hubungannya dengan Toksikologi Senyawa Logam*. Jakarta: UI Press.

Effendy, H. 2003. *Telaah Kualitas Air Bagi Pengelolaan Sumber Daya dan Lingkungan Perairan.* Yogyakarta: PT Kanisius.

Gandjar, I.G dan Rochman, A. 2007. *Kimia Farmasi Analisis*. Cetakan Kedua. Jakarta: Penerbit Pustaka Pelajar.

Khopkar, S.M. 1990. *Konsep Dasar Kimia Analitik.* Jakarta: UI Press.

Mulyono. 2006. *Membuat Reagen Kimia di Laboratorium*. Jakarta: PT Bumi Aksara.

Nisma, F. 2008. *Seleksi Beberapa Tumbuhan Air Sebagai Penyerap Logam Berat Cd, Pb Dan Cu Di Kolam Buatan FMIPA Uhamka*. Malang : Uhamka.

Suriawuria, U. 2005. *Air Dalam Kehidupan dan Lingkungan yang Sehat*. Bandung: PT. Alumni.

Vogel, A.I. 1994. Buku *Teks Anorganik Kulitatif Makro dan Semimikro*. Edisi Kelima. Jakarta: PT. Kalman Media Pustaka.

Widowati, W. Dkk. 2008. *Efek Toksik Logam Pencegahan dan Penanggulangan*. Yogyakarta: Penerbit Andi.