JOURNAL OF NATURAL SCIENCES AND MATHEMATICS RESEARCH

Available online at http://journal.walisongo.ac.id/index.php/jnsmr

The Study of Iron Metal (Fe) Content in Water Morning Glory Plants (*Ipomoea Aquatica Forsk*) using Atomic Absorption Spectrophotometry (AAS) Method

Khusnul Kholifah[1], Andi Fandlan[2], Wenty Dwi Yuniarti[3]
[1,2,3] Department of Physics Education, Faculty of Science and Technology, Universitas Islam Negeri Walisongo Semarang, Central Java, Indonesia

Corresponding author:
olifisika@gmail.com
Recived: 20 November 2015, Revised : 21 December 2015 Accepted: 30 December 2015.

Abstracts

There are several hazardous material compounds in water morning glory that cannot be consumed. This study aimed to Fe content in water morning glory taken from different locations using Atomic Absorption Spectrophotometry (AAS) method. The data were acquired through documentation method, observational method and experimental method. All of the data were analysed by quantitative approach and descriptive analysis. The number of samples taken was 3 pieces of water morning glory per location. From the AAS method, the results showed that Fe concentrations in all samples varied. The average of Fe content in water taken from Industrial area was 0,258 ppm, from green house was 0 ppm, and from rural area was 0,175 ppm. The numbers of Fe content in water morning glory taken from industrial area were 10,78 ppm, 9,0 ppm, 9,3 ppm; from green house were 1,9 ppm, 4,4 ppm, 2,4 ppm; and from rural area were 6,4 ppm, 4,94 ppm, 4,98 ppm. The results of the study showed that Fe content in water or water morning glory taken from *green house* and rural area was below the threshold level of metal contamination, meanwhile in industrial area, the Fe content was almost approaching the threshold level of metal contamination. In the industrial area, the water morning glory could be used to reduce water pollution, not as food sources because of the high content of Fe. Meanwhile, in green house and rural area, water morning glory might be consumed by people because of the low content of Fe.

Key words: Iron metal (Fe); Water morning glory; AAS mtheod.

1. Introduction

Majority, Indonesians work as farmer because Indonesia is an agricultural country having regions with extensive and lush soil. Agriculture refers to tillage effort to produce food plants. Agrarian society depends on agricultural sector as their main production.

Every region has different agricultural production such as vegetables. In human life, vegetables really play role in saturated food requirement and nutrient fulfillment. Vegetables constitute source of mineral, fiber and vitamin required for the health of human body.

Almost Indonesian people have known vegetables such as morning glory (*Ipomoea reptant*). Morning glory is a well-known leaf vegetable that is easy to be found in the market. There are two kinds of morning glory growing in Indonesian regions namely land morning glory and water morning glory. It contains high nutrients such as vitamin A, B_1, and C, and also protein, calcium, phosphorus, iron [1].

The water morning glories observed are taken from different locations. Since they are known by people as plants that relatively contain high iron substance, this study has been conducted to investigate the people assumption whether or not the water morning glory contains high Fe content. Based on the observation result carried out by *Bogor Agricultural University* (IPB), Fe content on leaf and fresh clover handle was 108.3 mg/100 g, much greater ~~as~~ compared to other vegetable such as spinach (3.5 mg/100 g), morning glory (2.3 mg/100 g), cassava leaf (1.3 mg/100 g), Chinese cabbage (2.9 mg/100 g), katuk (2.7 mg/100 g), and cowpea leaf (6.2 mg/100 g)[2]. So that in conducting the research, we have to know the normal content of metal on each result of the experiment derived from the analysis of Fe content in the samples. In general, the metal concentration in environments (earth, water, air) is very low, it is necessary to be suspicious if ascension of metal content happens.

Water pollution is caused by the input of materials such as gas, dissolved materials, and particle. Pollution comes into water in various ways, such as via atmosphere, earth, run off agricultural, domestic and urban waste, discharging industrial waste, etc [3]. In biological network system, metal contents also have particular concentration, either essential metal or non-essential metal. If essential metal content is indicated very low, it needs to be suspected that there is a deficiency phenomenon [4]. In non-essential metal if its content overshoot the normal level, it needs to be suspected that that there is a toxicity phenomenon [5].

The samples that will be analyzed according to their metal concentration are in the environment of air, earth, water, river sediment/beach, land plant/water, fish, and organism living around them. That metal content usually varies to terminological location so that the threshold level of concentration is different in needs. For example, the metal concentration which is in residential areas should be low and safe for human life so it will not lead to any problem for people who live in that region.

Iron has the chemical formula Fe from its Latin name, ferrum. Its atomic number is 26, and its molar mass is 55.845 grams per mole. It has a metallic gray colour and is attracted to magnets. Iron is the second most-abundant metal on Earth. Fe content in water morning glory can be indicated by various analysis methods, for example by AAS method. It is an accurate method to analyze substance in low concentrates with high accuracy.

AAS is an analytical technique that measures the concentration of elements. AAS is so sensitive that it can measure down to parts per billion of a gram ($\mu g\ dm^{-3}$) in a sample [6]. The technique makes use of wavelengths of light that are specifically absorbed by an element. The correspondence to the energies is needed to promote electrons from one in energy level to another, higher, energy level. AAS has many uses in different areas of science, such as in chemistry and physics area.

Physics is not always about formula, but it also gives contribution for environmental development and energy on the earth. Environmental physics in this research context is physics from human's physical environment (or being in a general way). So, it studies about principle of physics application on physical environment. It includes: (1) Air, (2) Earth and (3) Water, and the scope of this research is water.

In this article, to investigate the iron metal content in water morning glory and to find out the comparison of Fe content in water morning glory taken from different locations.

2. Experiments Procedure

Iron metal (Fe) content in water morning glory can be identified by Atomic Absorption Spectrophotometry (AAS). It is an accurate method for the analysis of substance in low concentration with good accuracy. Samples of plants were taken from nature. Water morning glory's sample was taken from farm (not near polluted areas) and from near industrial location. At the initial step, water morning glory was moved from its original habitat to pot. The media of its control was normal plants from green house. They were the planted morning glory's seeds in pot that had been placed in green house. It needs the plants out media attention from original habitat without chemical manure affix.

The media used in pot in green house was in accordance with the media in the original habitat without additional chemical manure and characterized Physics method through analysis environment impact with AAS method Next, the samples were prepared. They were taken from each plant with the same mass.

The measurement of Fe content on that plants used AAS. AAS method constitutes as the main tool on chemical modern for the identification of molecular structures. In organic chemistry, AAS method is used to determine and confirm molecular structures, to monitor chemical reaction and to know the purity of a compound.

This research was also based on long term growth and implant medium. After Fe content data were known, then, the data were analysed. The data analysis and observational result included table of the comparison of Fe content in water morning glory. The test of Fe content in water morning glory plants used AAS. AAS is an analysis method to determine the concentration of a piece of element that is based on absorption process of radiant energy. It works by atoms on ground state to excitation of exterior electron. Absorption process of energy happens on specifically wavelength to characterize each element. Radiological intensity that is absorbed proportional in atom amount of samples. So that, by measure radiation intensity that is transmitted, therefore element concentration in a pick can be determined.

This research ~~is~~ used super morning glory's seed (land morning glory/*Ipomoea reptant*) obtained from seed shop. The measurement of the Fe content was also conducted on fresh water morning glory planted out of green house as it was useful to compare the result with sample that was planted in green house. Plant media used was compost mixed with sand without chemical manure mixture.

3. Result and Discussion

Analysis of iron metal (Fe) by Atomic Absorption Spectrophotometry (AAS) was conducted via absorbance process of radiant energy by different atoms in ground state with wavelength (λ) = 248.3 nm. It was standard conditions and characteristics concentration checks for AAS method. The data of absorbance of Fe contents in the solution of sample destruction by AAS method, to be calculation in ppm, the calcultaion data of Fe content can be shown in Tabel 1.

Based on the data analysis that had been conducted (see Tabel 1), it was found that the concentration of Fe was 0.258 mg/L from industrial area, 0 mg/L from green house and 0.175 mg/L from rural area (Minister of Health Decree No. 907/Menkes/SK/VII/2002 about drinking water that contains 0.3 mg/L for Fe). Thus, the water taken from green house could be consumed. Meanwhile, water taken from industrial area and rural area contained high enough Fe content. Thus, it better unconsumed although still below the threshold level. There were other parameters to determine the feasibility of water, for example COD content, BOD, analysis microbe and other metals contents.

Table 1. The calculation of Fe content in the solution of sample destruction result.

No.	Sample	A_1	A_2	A_3	Mean (ppm)	Mean (mg/g)
1.	KA.1	10,9	10,9	10,52	10,78	107
2.	KA.2	8,97	9,26	8,78	9	90
3.	KA.3	7,142	10	10,64	9,3	93
4.	KB.1	1,78	1,95	1,85	1,86	18,6
5.	KB.2	4,07	4,59	4,64	4,4	44
6.	KB.3	2,42	2,45	2,35	2,4	24
7.	KC.1	6,4	6,43	6,4	6,4	64
8.	KC.2	4,6	5,16	5,09	4,94	49,4
9.	KC.3	4,92	4,98	5,05	4,98	49,8

A = Absorbance
KA = Water morning glory taken from industrial area
KB = Water morning glory taken from green house
KC = Water morning glory taken from rural area

Based on the Table 1, it can be seen that Fe content in the water morning glories taken from different locations are various. Fe content on leaves of the water morning glory is 59.97 mg/100 g, much greater as compared to the observational result of *Bogor Agricultural University* (IPB) in which Fe content on leaves of morning glory is 2.3 mg/100 g. The water morning glories are known by people as plants that relatively contain high iron substance (Fe). Based on procedural working, the water morning glories observations were taken from different locations. This study result was conducted to investigate the people assumption whether or not the water morning glory contains high Fe content.

Water taken from green house and rural area contained Fe content below the threshold level of metal contamination, stated in Minister of Health Decree No. 907/Menkes/SK/VII/2002, meanwhile water taken from industrial area contained Fe content approaching the threshold level of metal contamination. It meant that the water taken from industrial area could not be consumed by people. It also could not be used for agricultures. Meanwhile, water taken from green house and rural area might be used by people because it was safe.

The use of water as sample was purposed to compare the number of Fe content in water morning glory taken from different locations. Although Fe content in water taken from green house and rural area was standard, ~~but~~ people also had to consider another chemical content whether it was high or not. Besides, there were many parameters to approve whether the water could be consumed or not.

The water morning glories taken from industrial area could not be consumed by person because it contained high Fe content. It was caused by water pollution in industrial area so that the plant was not safe to consume. Meanwhile, the water morning glories taken from green house and rural area were safe to consume. Beside Fe content in water morning glory was not high, these locations contained low Fe content in water. Specially water from green house, there was no Fe content.

Thus, the carefulness of people before buying water morning glory in the market is important to know where water morning glory is taken from. Besides, people can see the physical form of water morning glory. If it seems clean and fresh, it means that the vegetables are safe to consume. If it seems pale, then better no to buy it. It is necessary to have tight observation by doing analysis to food materials routinely in the market to guard the product quality in the effort to protect consumers.

4. Conclusion

In conclusion, the average of iron metal (Fe) content in water taken from Industrial area was 0,258 ppm, from green house was 0 ppm, and from rural area was 0,175 ppm. The numbers of Fe content on water morning glory taken from Industrial area were 10,78 ppm, 9,0 ppm, 9,3 ppm; from green house were 1,9 ppm, 4,4 ppm, 2,4 ppm; and from rural area were 6,4 ppm, 4,94 ppm, 4,98 ppm. There were significant differences among Fe content in water morning glory taken from different locations. In the industry area, water morning glory could be used to reduce water pollution, not as food sources because its Fe content was high. Meanwhile, in green house and rural area, water morning glory might be consumed by people because its Fe content was not high.

Acknowledgment

The author wish to thank Department of Physics Education, Universitas Islam Negeri Walisongo Semarang for financial support in this research.

References

[1] Aji, Raos, *Investigasi Kandungan Logam Besi pada Tanaman Kangkung dengan Metode Magnetik, Thesis.* FMIPA Unnes, 2009.

[2] Mehdi, *Research by Bogor Agricultural University*, Bogor: IPB, 2003.

[3] Efendi, Hefni, *Telaah Kualitas Air (Bagi Pengelolaan Sumber Daya dan Lingkungan Perairan)*, Yogyakarta: Kanisius, 2003.

[4] *Deficiency* are lacking; lacking situation (something); lack for vitamin (*taken from by Popular Scientific Dictionary*). M. Dahlan Al Barrydan Pius A. Partanto, *Kamus Ilmiah Populer*, Surabaya: Arkola. 2001.

[5] *Toxicity* , Toxin is formed toxicant substance and issued by radical damage causative being in structured or fatal, wreck total life or efectivity being on one a part (*electroplated from Dictionary Outgrows digital Indonesian*, *KBBI v1.1*)

[6] Levinson, R., *This Leaflet is produced in association with The Royal Society of Chemistry Fine Chemicals and Medicinals Group*, Burlington House, Piccadilly, London WIJ OBA.