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# Effect of AsamKandis (*Garcinia xanthochymus*) Pulp in Decreasing Level of Mercury (Hg) and Plumbum (Pb) Content in Water Spinach (*Ipomea aquatica* Forssk)

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**Abstract:** Water spinach (*Ipomea aquatica* Forssk) is one vegetable plant that is consumed by people. Contamination of mercury (Hg) and lead (Pb) would cause health problems if it exceeds the allowable limit. The research aimed to determine the levels of mercury (Hg) and lead (Pb) content in water spinach from the plantation in Cakung Industrial Area in Jakarta and also determine variaous concentration of asamkandis solution that had most influence in decreasing levels of Hg and Pb content in water spinach. The research method was using wet and dry destruction, then the result ofthe destruction of the metal content was measured using Atomic Absorption Spectrophotometer (AAS) and analyzed using Indonesia standard method of SNI19-2896-1998andAOAC999.11/9.1.09.2005. Before immersion step, Hg level was 0,010mg/kg and Pb was0.070 mg/kg. After immersion step with asamkandis solution, highest decreases of Hg and Pb were obtained. Hg decreased up toof0.0080mg/kg(40.30%) andPb up to0.0400mg/kg(42.86%). It can be concluded that asamkandis can reduce the metal content and seem the citric acid responsible for it reducing capacity.
**Keyword :** Hg, Pb metals, Water spinach(*Ipomeaa quatica* Forssk), AsamKandis (*Garcinia xanthochymus*), Atomic Absorption Spectrophotometer(AAS).

## Introduction

Waters area polluted by metal waste might be dangerous for living things. Certain metal were very dangerous if found in high concentration inside environment (water, soil, and air) because these metal could damage tissues of living things[1,2]. Environmental pollution by dangerous metals (Cd, Pb, Hg) might occurred if people or factories, that used the metal for production process, didn't care about environmental safety and monitor their waste that passed through river in which its water was used by people nearby for daily lives. Industrial area in Jakarta, such as Cakung Industrial Area, had automotive, logistic, and transportation rental industries which involve heavy metal in the production process. Many people plant variety of vegetable, one of it is water spinach. Apparently, water spinach was one of plants that was easy to absorb heavy metal from its growth media, while it was often consumed and was easily planted or grow in empty land near the river that was used for its water source [3]. Plants lived in water, such as water spinach, velvetleaf, lettuce, spinach, hyacinth, that were polluted by heavy metal would be biologically (bioaccumulation) accumulated into the plant's matrix tissues. Some heavy metals that often polluted river were Ca, Cd, Co, Cr, Fe, Ni, Pb, Hg. River pollution by Hg and Pb would cause contamination of nearby plants [4],were researches towards ability of some

plants to absorb heavy metal from polluted water. Green leafy vegetables have been recognizeed as rich source of micronutrients (minerals and vitamins) and antioxidants [5]. Water spinach (*Ipomoea aquatica* Forsk) is a vascular semi-aquatic plant native to tropics and subtropics that grow wild and sometime cultivated in Southeast Asia[6]. Water spinach is a herbaceous perennial plant belonging to the family *Convolvulaceae*, and commonly use this plant as food vegetables. The pericarp of asamkandis has been used for a long time in Sumatra island as a traditional medicine and food ingredient. In comparison to other fruits, asamkandis contains phenolic compounds, and organic acids, which makes it acidic[7]. According to research conducted, asamkandis contained major organic acid from leaves (1.7%), fruit (2.3%), and dried rind (12.7%). Most of its flavor was sour because it contained citric acid so that its pulp might be used to reduce metal level. [8]. The presence of the substance might also interact with metal that available apply for treatment of reducing content of heavy metal in vegetables.

## Experimental

a. **Preparation of water spinach sample and asamkandis solution**.

Water spinach (*Ipomoea aquatica* Forssk) was first cleaned using fresh water. Then its leaves and young stem were separated and cleaned using aquadest. After that, water spinach was chopped, and about 15 gram of it was made for sample names before treatment. After that, it was immersed with asamkandis solution of various concentration (5%, 10%, 15%, 20^, and 25%)for 30 minutes.

**b. Measurement of Hg and Pb metal level within sample**

The sample which had been destructed was measured using Atomic Absorption Spectrophotometer (AAS) with result as follow; Hg's lambda was 253.7 nm and Pb was283.3 nm.

**Data Analysis**

Data resulted from the absorption process of sample and asamkandis solution shown in form of metal concentration. The metal level contamination within sample was measured using formula according to SNI 19-2896-1998 and AOAC 999.11/9.1.09.2005. [9]. The data of metal level contamination within sample was then formulated using linear equation.

Formula for counting metal level within sample (*recovery*) :

$$C = \frac{(D-E)\,xFP\,x\,V\,x\,{}^{1}/_{1000}}{W}$$

Note :
C was metal level (mg/Kg)
D was sample level from AAS reading result ($^{\mu g}/_{L}$)
E was blank level from AAS reading result($^{\mu g}/_{L}$)
V was final solution volume (mL)
W was sample's weight (gram)

## Result and Discussion

**1. Biological identification**

Sample used in this research was water spinach. Water spinach is one of plants that could absorb metal pollution from nearby environment. It was taken from Cakung Industrial Area, East Jakarta, from one plantation at five growth points (four form corner and one from middle). Sample of water spinach was determination by LembagaIlmuPengetahuan Indonesia (LIPI) Biology Reaserch Centre in Cibinong, Bogor, Indonesia The sample used was identified as *Ipomoea aquatica* Forssk from family *Convolvulaceae*. Asamkandis was obtained from Ijem Herbal Company, Yogyakarta, Indonesia. Biological determination of asamkandis was conducted in LIPI Cibinong, Bogor, Indonesia and the plant used was identified as *Garcinia xanthochymus* from *Clusiaceae* clan.

### 1. Result analysis of Hg and Pb level in sample before treatment

The result analysis of mercury (Hg) and lead (Pb) level in sample before immersion with asamkandis solution was measured using Atomic Absorption Spectrophotometer (AAS). The result analysis could be seen in the following table:

**Table 1. Result Analysis of Pb and Hg Metals Level in Sample before Treatment**

| Metal | Metal level (mg/Kg) | | Mean | SD | %RSD |
|---|---|---|---|---|---|
| | I | II | | | |
| Hg | 0.0147 | 0.0120 | 0.0134 | 0.0018 | 13.3596 |
| Pb | 0.0661 | 0.0739 | 0.0700 | 0.0018 | 5.5204 |

According to SNI 7387:2009, maximum tolerance level of Hg was 0.03 mg/kg and Pb was 0.5 mg/kg. Based on the result, metal level in water spinach sample from Cakung Industrial Area didn't exceed the maximum tolerance level. However, we need to concern that the metal content consumed might be accumulated within the body who consumed it. Therefore, it would be better if the metal content could be reduce so that it wouldn't be harmful for people who consumed it in large amount repeatedly in near time.

This research was conducted to reduce metal level of Hg and Pb in water spinach with various concentrations of asamkandis solution. As the result, for 30 minutes immersion, the highest decrease was found at 25% concentration. Hg reduced up to 0.0080 mg/Kg (40.30%) and Pb up to 0.0400 mg/Kg (42.86%)

### 2. Result analysis of Hg and Pb level in sample after treatment

The result analysis of decrease mercury (Hg) and lead (Pb) level in sample after 30 minutes immersion with various concentrations of asamkandis solution was measured using Atomic Absorption Spectrophotometer (AAS). The result analysis could be seen in the following table.

**Table 2. . Result Analysis of Hg and Pb Level in Sample**

| Concentration of AsamKandis Solution | Hg Metal Level in Sample (mg/Kg) | Percentage of Decrease from Hg Metal Level | Pb Metal Level in Sample (mg/Kg) | Percentage of Decrease from Pb Metal Level |
|---|---|---|---|---|
| 5% | 0.0101 | 24.63 | 0.0531 | 24.21 |
| 10% | 0.0104 | 22.39 | 0.0512 | 26.90 |
| 15% | 0.0096 | 28.36 | 0.0480 | 31.43 |
| 20% | 0.0089 | 33.58 | 0.0426 | 39.21 |
| 25% | 0.0080 | 40.30 | 0.0400 | 42.86 |

From the table, the decrease was seen. It mean that citric acid contained in asamkandis could bind heavy meta; in sample as shown on the following curve:

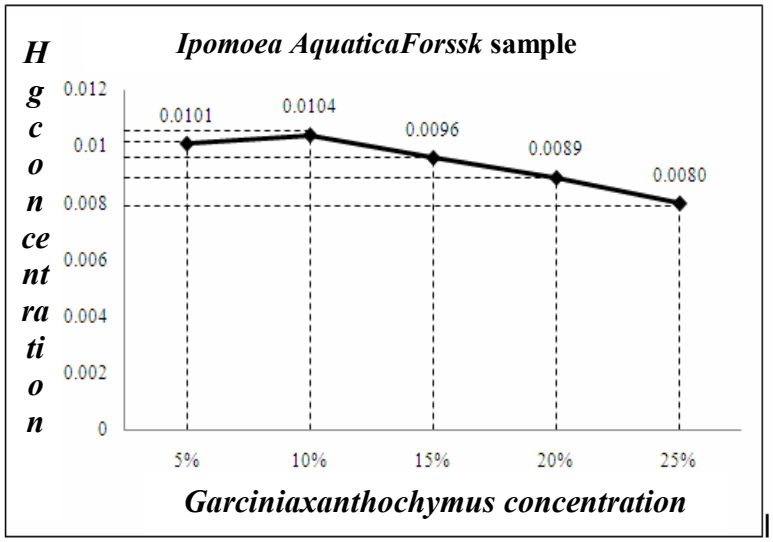


**Figure 1. Mercury Level (Hg) Curve**

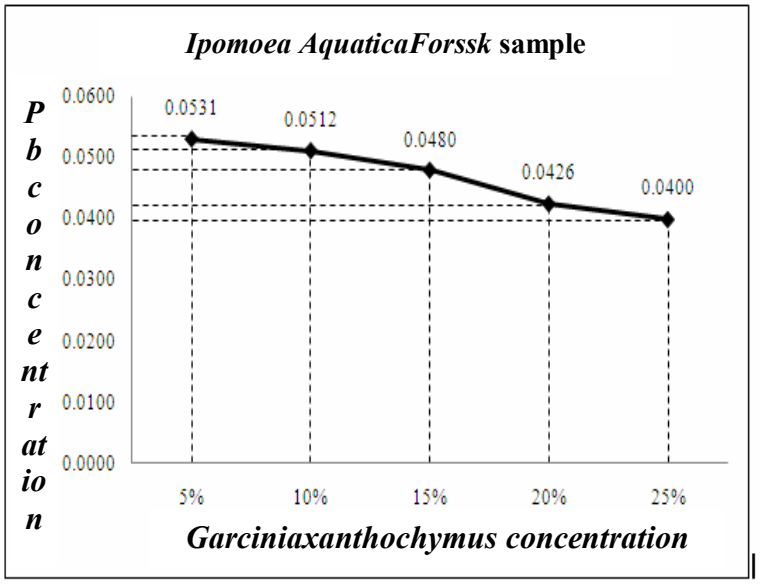


**Figure 2. Lead (Pb) Level Curve**

Asamkandis contained citric acid so that it might be useful as metal binder. Thereby, it might reduce metal level within sample.

To make asamkandis solution, it was measured and divided into various weights (5, 10, 15, 20, and 25 g). Each weight was then diluted slowly in 100 ml aquabidest. After that, it was stirred inside beaker glass until no powder agglomerated. Water from the stirring process was put into 100 ml measuring cylinder and added aquadest up to tera sign. As result, various concentrations of asamkandis solution were obtained; 5%, 10%, 15%, 20%, and 25 %. Citric acid was tricarboxylic which naturally found in fruits. Each of its molecule contained carboxyl cluster and one hydroxyl cluster which was bundled on carbon atom. Citric acid was very effective as metal binder. Carboxylyl ion was fine electron donor so that it might bound metal in form of complex electron bond [9]. Fresh water spinach, in which its leaves and young stem had been separated, was washed three times with clean water to remove dirt. It was then rinsed with aquadest tomake sure that no metal detected in the sample surface. After that, it was chopped and ready to be prepared. The sample was measured to 15 gram and so the immersion was conducted with concentrations of 5%, 10%, 15%, 20%, and 25 % for 30

minutes. Last it was dried and stored inside glass bottle so that metal level estimation; that was bounded with citric acid, could be obtained with reading by Atomic Absorption Spectrophotometer (AAS).

After that, two destruction procedures were conducted; wet and dry destructions. Destruction had function to cut bonding between organic compound and metal which would be analyzed. From the procedure, it was expected that only metal that would be left on sample. In this research, the two procedures were used according to SNI 19-2896-1998 to determine mercury (Hg) metal level either on water spinach or asamkandis solution. Wet destruction generally might be used to determine metal level, which couldn't stand heat. As for determining lead (Pb) metal level in asamkandis solution, wet destruction was also used because it wasn't possible to use hot destruction process which had to go through drying process by oven that would cause asamkandis solution to evaporate. In order to determine Pb metal level in water spinach, wet destruction was used to avoid dopants. Position when the sample was taken could have effect towards heavy metal level in water spinach. The closer to the spot where the water flow, would make heavy metal level in water spinach increased.

Hg and Pb wet destruction process used different technique and chemical material. This was in accordance with SNI 19-2896-1998. Hg wet destruction process was where subtle water spinach and asamkandis solution were measured less than 0.5 gram and added by 6 ml $HNO_{3(P)}$, 0.5 ml $H_2O_{2(p)}$. After that, it was left for 45 minutes, so that the plant tissue might perfectly decompose. Next, aquadest was added up to 15 ml scale. Then, it was heated at 90º C temperature for ± 5 hours. This heating process was aimed to avoid heavy evaporation. So then it was filtered using filter paper. Sample was next stored inside 50 ml volumetric flask and added by 2.5 ml HCl 16%. Last, aquadest was added up to border line. Thesolution was ready to be measured by Atomic Absorption Spectrophotometer (AAS). As for measuring Pb metal level within asamkandis solution using wet destruction, the solution was first measured to 10 gram. Htne it was stored in beaker glass and added by 5 ml $HNO_{3(P)}$, 5 ml HCl 6M, and 0.5 ml $H_2O_{2(P)}$. Afterward, it was heated for ± 30 minutes until it looked crystal clear and then left until it reached cool temperature. Next, it was filtered using filter paper; whatman no 42. Sample was then stored inside 50ml volumetric flask and aquadest was added up to border line. The solution was ready to be measured by Atomic Absorption Spectrophotometer (AAS).

Hg metal analysis needed *hybrid vapourgeneratorFlow Injection Analysis System* (FIAS) Perkin-100. This was because Hg evaporated easily. The Hg atomic gas was reacted in acid condition with $NaBH_4$, NaOH, and HCl by FIAS Perkin-100. After that, the absorbent reading was conducted using Atomic Absorption Spectrophotometer (AAS).

Water spinach lived in polluted media might absorb heavy metal nearby along with nutrition absorbed by its root. This was worrisome because water spinach was consumed by most people as nutritional and cheap food. It would be more dangerous if it consumed repeatedly for long time because it might accumulate in body. It could toxic or damage mental, behavior and cause anemia. At more severe toxic degree, it could cause vomiting and serious damage in neuron system, brain system damage and genetic abnormality.

## Conclusion

Based on the research conducted, mercury (Hg) and lead (Pb) level in water spinach cultivated at plantation near Cakung Industrial Area, in Jakarta it was concluded that metal contamination in water spinach was still eligible to be consumed. Mercury (Hg) and lead (Pb) metal level in water spinach didn't exceed maximum limit according to SNI 19-2896-1998; Hg metal level was 0.03 mg/kg and Pb was 0.5 mg/kg.

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