Effect of Tamarind

by Yusnidar Yusuf

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CHALLENGES OF THE DEVELOPMENT OF NATURAL COMPOUND AS DRUG FOR INFECTIOUS & DEGENERATIVE DISEASES

Faculty of Pharmacy & Sciences
University Of Muhammadiyah Prof. DR. HAMKA
(UHAMKA)
Jakarta, January 10, 2015

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Remarks of the Dean of Faculty of Pharmacy & Sciences (FFS) UHAMKA

Assalamu'alaikumWr.Wb.

Distinguished ladies and gentlemen

First of all, on behalf of FFS UHAMKA, I would like to welcome to all of you in FFS UHAMKA Jakarta. Thank you very much for your attention to come and attend the international seminar in FFS UHAMKA. I hope we are all in health condition and in the shadow of God.

The conference is organized by FFS UHAMKA in collaboration with sponsors like PT. Triasindo Jaya , Indolab and UHAMQUA. This event is as part of the routine activities with the purpose are: discuss an update on the challenges of drug development for infectious and degenerative diseases based on natural product and provide a forum for exchange of information on the latest technologies involved in the development of natural compounds as drug.

In this seminar participants from student, lecturer, researchers have been attanded and 4 speakers within field of Pharmaceutical sciences will be presented paper with theme "Natural Compound as Therapy for Infectious and Degenerative Diseases". Besides that, this conference followed by presentation researchers in form of oral and poster presentation. Herewith we would like to express our gratitude to all participants, presenters, and special thanks to plenary speakers for joint us to day to share advance knowledge and expertise in this scientific event in FFS UHAMKA.

The FFS gratefully acknowledges the Rector of UHAMKA University, minister of Health of Indonesia, and sponsors for the nice collaboration in bringing this seminar. Furthermore, personally, I would like to express my deep appreciation to members of the Organizing Committee, for the good teamwork and their great effort to bring success to the seminar.

Finally, I wish all participants could benefit from the seminar and have an enjoyable moment in FFS UHAMKA Jakarta.

I look forward to thank you all for attending this seminar

Wassalamualaikum Warrohamatullahi Wabbarokatuh

Drs. H. Budi Arman, M. Kes, Apt.

Remarks From Rector

Bismillahirahmanirrahim,

Your Excellency, Minister of Health Republic of Indonesia
Respected Resource Persons
Respected Participants, Ladies and Gentlemen

On behalf of University of Muhammadiyah Prof. Dr. HAMKA (UHAMKA), I would like to warmly welcome you all to attend and participate in the International Seminar on "Challenges of the Development of Natural Compound as Drug for Infectious and Degenerative Disease," on Saturday, January 10, 2015 at Auditorium UHAMKA.

This international seminar is a very prestigious and academic event which has to be appreciated since the topics and sub-topics such as Natural Product Chemistry, Pharmacology, Molecular Biology and Biotechnology and Pharmaceutical Technology & Compound are crucial issues today, particularly in the pharmaceutical discipline.

This academic event becomes more significant as there are some respected experts and resource persons who know how in the field of pharmacology, biotechnology, pharmaceutical technology and compound. Through this seminar, they present their research findings and scientific experiences and share them to the participants. We wish that all participants will get valuable lesson learned from these resource persons and experts.

In addition to the presentation from keynote speaker and experts, there are also poster sessions which display the research findings which, hopefully, inspire other participants to make further research dealing with the current issue in the development of natural compound as Drugs for Infectious and Degenerative Diseases.

To make this international seminar successful, I do hope that all participants are very active to quest and explore the given ideas occurred during this seminar so that this will provide significant contribution to the development of pharmacy in particular and drugs or medicines in general for the sake of humanity health.

At last, I would like to express my sincerely thank all resource persons, Prof. Dr. Nila Djuwita F. Moeloek, Sp.M (K) (Minister of Health Republic of Indonesia) , Prof. Dr. Ibrahim Jantan (UKM), Prof. Dr. Endang Hanani, SU., M.Si (UHAMKA), Prof. Dr. Oliver Kayser (The Technical Biochemistry, TU Dortmund, Germany), and Prof. Dr. Krisana Kraisintu (Faculty of Oriental Medicine, Rangsit University, Thailand).

Jakarta, January 2015

Rector,

Prof. Dr. H. Suyatno, M.Pd.

EFFECT OF TAMARIND (*Tamarindus indica* Linn.) IN DECREASING CONTENTS OF MERCURY (Hg) AND PLUMBUM (Pb) IN WATER SPINACH (*Ipomoea aquatica* Forssk.)

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ABSTRACK

Water spinach is one of vegetables that often consumed by people, however it dangerous if it is contaminated by heavy metal which exceeds high maximum level metal limit of contaminated vegetables by Indonesian National Standard 7378:2009 Hg 0,03 mg/kg and Pb 0,5 mg/kg. This research is aimed to figure out the contents of mercury and plumbum in water spinach, study the effect of tamarind solution in variety concentration, and also to acquaint the finest concentration of tamarind solution which can reduce the Hg and Pb levels in 30 minutes of soaking. The content of Hg was in level 0,0134 ± 0,0018 mg/kg and Pb 0,0700 ± 0,0055 mg/kg in water spinach before the experiment. However, the water spinach was cultivated to be not containted by any metal levels which can be harmful for society that consume it in large number and repeatedly so that the metal will be accumulated in body. The soaking analysis with tamarind solution variety concentration of 5, 10, 15, 20, and 25% has resulted in metal level decreased. 25% concentration showed the best metal level decreased; Hg 0,0074 ± 0,0009 mg/kg (45%) and Pb 0,0379 ± 0,0046 mg/kg (46%).

Keywords: Tamarind, water spinach, mercury, plumbum, and atomic absorption spectrophotometer (AAS)

INTRODUCTION

One of industrial waste that can cause pollution is heavy metal waste. Plants are one of mediators of heavy metal disseminator on living thing. Heavy metal can enter plant through root and stoma.

Industrial area in Jakarta, such as Cakung Industrial Area, has 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. Related to many of people's agriculture at Cakung Industrial Area, the vegetable planted was worried to be polluted by Mercury (Hg) and Plumbum (Pb). This was due to water source for the water spinach land came from rain and sewer, which was part of industrial and domestic wastes disposal, located around the land.

Heavy metal contained in the vegetable could be dangerous for human body. Therefore, an effort was needed to reduce Hg and Pb waste in vegetable consumed by human. Degradation content of heavy metal could be conducted by adding ligand or sequestran. Sequestran most often used on food was citric acid (Winarno 1997). According to research conducted by Napitupulu (2008), tamarind contained 15% of citric acid so that its fruit could be used to reduce metal content.

Based on the explanation above, we had interest to check Hg and Pb contents in water spinach and then conducted research to reduce Hg and Pb contents by tamarind solution with concentration of 5, 10, 15, 20, and 25% for 30 minutes using Atomic Absorption Spectrophotometer. This research was expected to find the best treatment in order to reduce Hg and Pb contents in water spinach using tamarind in easy, simple, and effective way so that it could be socialized to society as general, and particularly to housewives and food seller. Moreover, this research was expected to avoid exposure effect of Hg and Pb.

MATERIAL AND METHOD

Material

Water spinach (*Ipomoea aquatic* Frossk.), fresh tamarind (*Tamarindus Indica* Linn.), $Hg(NO_3)_2$ 1000 mg/l, $Pb(NO_3)_2$ 1000 mg/l, HCl 16%, HCl 3%, HCl 6M, $H_2O_{2(p)}$, $HNO_{3(p)}$, HNO_3 0,1M, HNO_3 5N, $NaBH_4$ 0,2%, NaOH 0,05% from *Merck* dan aquabidest.

Method

Water spinach was obtained from farm near Cakung Industrial Area and tamarind (separated from its seed) was obtained from Ijem herbal. Making tamarind solution concentration, fresh seedless tamarind was taken for the amount of 5, 10, 15, 20, and 25 gram to be mashed and dissolved with 100 ml of aquabidest. 15 gram of chopped water spinach was soaked into tamarind solution for 30 minutes within each concentration. After that, water spinach was seeped and re-washed by aquabidest, meanwhile tamarind solution was kept inside glass bottle.

Destruction conducted was wet and dry destructions. Calculation of mercury (Hg) and Plumbum (Pb) contents in water spinach and tamarind solution used wet destruction (Badan Standardisasi Indonesia 1998). Measurement of mercury (Hg) content in sample solution that has been destructed was reacted with $NaBH_4$ 0,2%,

NaOH 0,05%, and HCl 3% by the assistance from FIAS perkin-100 equipment alongwith absorbent reading using atomic absorption spectrophotometer with 253.7 nm wave-length. The absorbent level obtained was still in range of mercury solution standard calibration curve. Measurement of Plumbum (Pb) content in sample solution that has been destructed was measured by absorbent using atomic absorption spectrophotometer with 283.3 nm wave-length. The absorbent level obtained was still in range of plumbum solution standard calibration curve.

Data of metal concentration obtained from atomic absorption spectrophotometer was calculated using formula according to Association Of Analytical Communities 999.11/9.1.09.2005 and Indonesian National Standard 19-2896-1998.

Formula to calculate metal content on sample (recovery):

$$c = \frac{a \times v}{m}$$

Note :
c is metal content (mg/kg)
a is metal concentration (µg/L)
v is solvent volume (L)
m is sample weight (g)

RESULT AND DISCUSSION

Water spinach was plant that absorbed heavy metal contained within its growth media. The heavy metal came from domestic, agricultural, or industrial waste. Plant mechanism or adaptation towards metal pollution was by forming phytochelatin which would tie heavy metal its environment. Phytochelatin was small peptide which was rich of amino acid where there was carboxyl functional group. Carboxyl group in amino acid could tie the metal (Prasetyawati 2007).

Before reading by Atomic Absorption Spectrophotometer (AAS), sample must be destructed first in acid room. There were two procedures used; wet and dry desructions. Function of destruction was to cut bond between organic compound with the analyzed metal so that only the metals would be left. Dry destruction process had weakness; temperature used for dusting was relatively very high and needed long time. Wet destruction process used mix of strong acid (which most of it was dangerous) so that there was potential of acid contamination. However, both procedures were used

within this research according to Association Of Analytical Communities 999.11/9.1.09.2005 and Indonesian National Standard 19-2896-1998.. In order to determine mercury (Hg) content on water spinach and tamarind solution, wet destruction was used because wet destruction generally could be used to determine metal element that was weak to heat, so that Hg woul not be loss. The same procedure also conducted to determine plumbum (Pb) content because it was not possible to start dusting process in electrical furnace used in dry destructiom processs.To determine Pb content in water spinach, dry destruction could be used to avoid polluter.

Analysis of Hg needed *hybrid vapour generator* which was a *Flow Injection Analysis System* (FIAS) Perkin-100. This was because mercury was easy to vaporize so that Hg atomic vapour would be formed after reacted in acid condition with $NaBH_4$, NaOH, and HCl with FIAS Perkin-100. Atomization process of mercury was as follow, Hg atom within sample as positive ion was reducted until it became neutral `and vapoured as free atom in normal temperature. As redactor, $NaHB_4$ and NaOH inside HCl could be used. After that, vapour of Hg atom together was flown through gas cell which was followed by absorbent reading using atomic absorption spectrophotometer (Pangabean dkk 2010).

The mercury (Hg) and Plumbum (Pb) contents in water spinach before submersion with tamarind solution was analyzed using atomic absorption spectrophotometer. The result was shown on table as follow:

Table 1. Analysis Result of Hg and Pb metal in Sample before Treatment Compared to Indonesian National Standard 7378:2009

Metal	Metal Content (mg/kg)		Mean	Maximum Limit of Metal Content on Vegetable According to SNI (mg/kg)
	I	II		
Hg	0.0146	0.0121	0.0134	0.03
Pb	0.0661	0.0739	0.0700	0.5

Based on the analysis, Hg and Pb metal content from agriculture land near Cakung Industrial Area did not exceed maximum limit of metal contamination on vegetable. This was possible because industries in Cakung had managed their waste before it was discarded. As result, metal contamintation was not high and fulfill standard of edible consumption. However, Hg and Pb content in water spinach could be caused by air and water pollution. Air pollution was caused by industrial and vehicle

smoke, whereas water pollution was caused by rainpolluted by indusrial smoke and industrial waste that was not perfectly manage. These pollutions could enter soil and then sediment as poisonous chemical substance.

Although the heavy metal content in water spinach did not exceed the limit, however, it would be wise if the metal content could be reduced so that it would not be harmful for people who often consumed it in large number repeatedly. Toxicity of Hg and Pb metal was high level toxic. Metal content that was absorbed into the body could not be destroyed, but it would stay inside and wasted later through excretion.

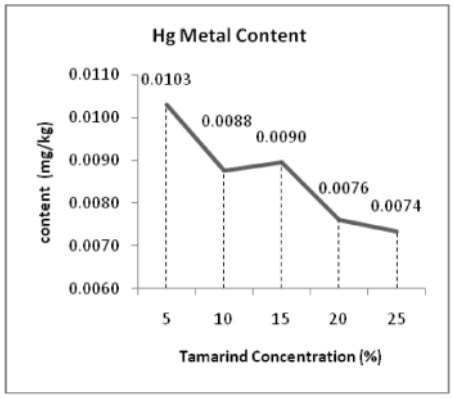
Therefore, this research was an effort to reduce Hg and Pb metal conent in water spinach with submersion of various concentration of tamarind solution for 30 minutes. The result was shown in table below:

Table 2. Percentage Hg and Pb Content Degradation after Treatment

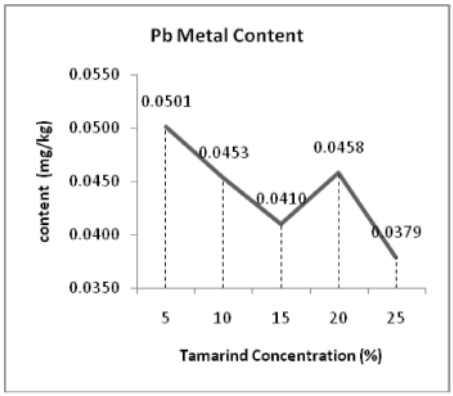
Tamarind Solution Concentration	Metal Content (mg/kg)									
	Mercury (Hg)					Plumbum (Pb)				
	I	II	Mean	SD	%	I	II	Mean	SD	%
Control negatif	0,0146	0,0121	0,0134	0.0018	-	0,0661	0,0739	0,0700	0.0055	-
5 %	0.0111	0.0095	0,0103	0.0011	23	0.0527	0.0475	0.0501	0.0037	28
10 %	0.0093	0.0082	0,0088	0.0008	34	0.0485	0.0421	0.0453	0.0045	35
15 %	0.0090	0.0089	0,0090	0.0001	33	0.0448	0.0372	0.0410	0.0054	41
20 %	0.0094	0.0058	0,0076	0.0025	43	0.0474	0.0442	0.0458	0.0023	35
25 %	0.0080	0.0067	0,0074	0.0009	45	0.0411	0.0346	0.0379	0.0046	46

From the analysis result of Hg and Pb metal content in water spinach after submersion, we could see tha thre was reduction of metal content in each concentration of tamarind solution. The highest reduction occurred in 25% concentration of tamarind solution with 45% reduction of Hg content 0.0074 ± 0.0009 mg/kg and 46% for Pb 0.0379 ± 0.0046 mg/kg. Tamarind contained 15% of citric acid. Citric acid was a trycarboxylic acid which was naturally available in fruits. Citric acid was very effective as metal binder. Carboxylic ion was a good electron donor so that it could bind metal in form of complex electron bond (Indasah 2002).

Graphic 1. Graphic of Hg Metal Content Content in Water Spinach



Graphic 2. Graphic of Pb Metal in Water Spinach



From the graphic above, we could see metal reduction on water spinach was not linier in each concentration. Only 5% concentration difference so that it looked the same. The analysis result showed that there was Hg and Pb metal content on water spinach and that there was degradation of heavy metal after submersion of tamarind solution for 30 minutes. The solution later was analyzed with atomic absorption spectrophotometer and proofed to be contained by heavy metal. It meat that citric acid contained in tamarind solution could bind heavy metal on sample. From the research result and discussion above, reduction of heavy metal content in water spinach or in other food can use tamarind fruit.

CONCLUSION

Based on research result, it was acknowledged that water spinach taken from Cakung Industrial Area contained Hg 0.0134 ± 0.0018 mg/kg and Pb 0.0700 ± 0.0055 mg/kg. There was degradation of Hg and Pb metal in water spinach after submersion of various concentration of tamarind solution; 5, 10, 15, 20, and 25% for 30 minutes. Highest reduction occured on 25% concentration of tamarind solution with 45% reduction of Hg content 0.0074 ± 0.0009 mg/kg and 46% for Pb 0.0379 ± 0.0046 mg/kg.

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