1. Result of the manuscript review (4-1-2016)
    - JT review form
    - Manuscript
2. Revised process (12-1-2016)
    - Manuscript after added new data
3. Revised process (15-1-2016)
    - Evaluation form for journal
    - Manuscript after revised
4. Revised process (4-2-2016)
5. Resume author responses (11-2-2016)
6. Final check (22-2-2016)
7. Manuscript status (26-2-2016)
8. Published (18-4-2016)

Hasil review naskah Heavy Metal

Dari: Rosita Dwi Chandra,S.TP, M.FoodSt(Adv) (rosita.dwi@machung.ac.id)
Kepada: Fronthea_thp@yahoo.co.id
Cc: fronthea_thp@undip.ac.id; monika.nur@machung.ac.id
Tanggal: Senin, 4 Januari 2016 09.03 WIB

Yth. Ibu Fronthea,

Berikut saya kirimkan hasil review naskah Ibu yang sudah direview oleh Ibu Kapti Rahayu. Saya juga menyampaikan komentar beliau "Sebetulnya saya agak kesulitan karena paper sangat sederhana, yang biasanya hanya dimuat sebagai "Short Communication" beberapa lembar saja".
Mohon untuk Ibu memperbaiki naskah sesuai komentar yang diberikan.
Terima kasih untuk perhatian dan kerja sama yang diberikan.

Salam,
Rosita

JT Review Form 2015 Special Issue (Fronthea Swastawati).docx
35.3kB

Heavy Metal_Dr.Fronthea (21.12.15).doc
1.3MB

Jurnal

Teknologi

Full Paper

ANALYSIS OF HEAVY METAL CONTENT IN *ANANDARA GRANOSA*: A CASE STUDY OF 10 MARKETS IN SEMARANG, CENTRAL JAVA, INDONESIA

Article history

Received

Received in revised form

Accepted

Nanik Heru Suprapti[a], Aziz Nur Bambang[b], Fronthea Swastawati[c], Ahmad Ni'matullah Al Baari[d], Adriyan Pramono[e]

*Corresponding author

fronthea_thp@undip.ac.id

[a]Department of Biology, Faculty of Science and Mathematics, Diponegoro University, Semarang

[b]Utilization Study of Water Resources Program, Department of Fisheries, Faculty of Fisheries and Marine Sciences, Diponegoro University, Semarang

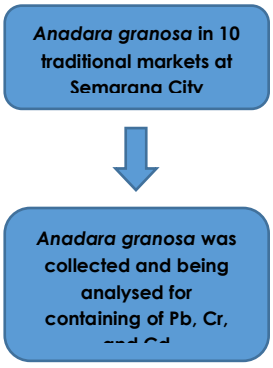
[c]Fishery Products Technology Studies Program, Department of Fisheries, Faculty of Fisheries and Marine Sciences, Diponegoro University, Semarang

[d]Laboratory of Chemistry and Food Nutrition, Faculty of Animal and Agriculture, Diponegoro University, Semarang

[e]Department of Human Nutrition/Centre of Nutrition Research (CENURE), Medical Faculty, Diponegoro

University, Semarang

Graphical abstract



Abstract

The purpose of this study was to determine the concentration of heavy metals such as lead (Pb), chromium (Cr), and cadmium (Cd) contained in the shells of *Anadara granosa* taken from 10 markets in the city of Semarang, Central Java, Indonesia (Johar, Genuk, Gayamsari, Teak, Peterongan, Karangayu, Mangkang, Pedurungan, Boom Lama, and Ngaliyan). The concentration of heavy metals of *Anadara granosa* were analyzed using Atomic Absorption Spectrometer (AAS). Analysis of variance (ANOVA) showed that heavy metals (Pb, Cd, and Cr) of shells taken from 10 markets showed a highly significant difference ($P<0.01$) on the content of Pb, showed no significant difference ($P>0.05$) on the content of Cd and Cr. High Pb content of the shells is derived from the shells at Pedurungan market of 0.24 ± 0.01 mg ·kg^{-1}. Levels of *Anadara granosa* that have a high Cr content is derived from the market Gayamsari market 0.09 ± 0.00 mg ·kg^{-1}. While high Cd comes from the shells obtained in the Genuk market of 0.62 ± 0.00 mg ·kg^{-1}. Accumulation of heavy metal contamination such as Pb, Cr, and Cd in shellfish could affect the micronutrient status and consumer health.

Keywords: *Anadara granosa*; heavy metals; micronutrients inhibitor; traditional market of Semarang City

1.0 INTRODUCTION

Heavy metals such as lead (Pb), chromium (Cr), and cadmium (Cd) are toxic contaminants that can cause biochemical changes and bioaccumulation in aquatic and its organisms. Not only adversely affect aquatic organisms, but also for humans who consume metal toxic fish products will also get negatively impacts. For example, heavy metals Pb easier to accumulate in the body of children [1]. The recent study pinted out that the accumulation of Pb is not only in the organs or in the blood, but also in the adipose fat tissue [2]. Pb and Cd poisoning in children can cause to chronic malnutrition due to micronutrients deficiency and impaired brain developmental [3]. Anadara granosa is a fishery products which is able to accumulate heavy metals. *Anadara granosa* is one type of shellfish that have the potential and economic value to be developed, as a source of protein and essential minerals to meet the nutrient adequacy in public health situation. *Anadara granosa* are an infauna, which is life in a way to immerse them selves in the mud, beneath the surface in shallow water [4]. The accumulation of Pb, Cr, and Cd in *Anadara granosa* through human consumption can be detrimental to health problem such as decreased renal function, memory loss, respiratory tract disorders, impaired liver function, and cancer [5–10].

The accumulation of Pb, Cr, and Cd inside the *Anadara granosa* is caused due to the nature or way of life, settle and obtain their food by means of "filter feeders" that can accumulate metals above their own environment. In addition, due to differences in substrate where life and the life of older shells also allows of metals accumulate more than younger shells [11]. The purpose of this study was to evaluate Pb, Cr, and Cd levels inside the *Anadara granosa*. This study result are expected in the future socialization is needed to provide a way to solve this problem out, for example by purification of *Anadara granosa* before processing.

2.0 EXPERIMENTAL

2.1 Material Research

Materials used in this study are shells of *Anadara granosa* taken from 10 traditional markets mentioned above as each 1 kg of shells from every market with the size 3 cm to 5 cm and weight of 10 g. Samples were taken using a plastic bag, camera, label, box sterofoam.

2.2 Research Methods

2.2.1 Sampling of the Shells

About 500 g sample was taken directly from the traditional markets located in Semarang. The sample is then washed to remove dirt and then boiled to separte the shells and shellfish meat.

2.2.2 Testing of Heavy Metals by Atomic Absorption Spectrometer [12]

About 50 g sample is taken and then dried at a temperature of approximately 100 °C, then mashed into a form such as powder. Samples were dissolved into the vessel of 500 mg and was added nitric acid and perchloric acid in 1 mL and 2.5 mL of distilled water. Then the sample was put in a microwave digestion. Subsequently, the samples were analyzed using Atomic Absorption Spectroscopy (AAS). The working of this method was done by comparing the absorbance of the sample solution with the standard solution comparator to obtain the concentration of sample. Scale absorbance of AAS was calibrated with a standard series of known concentration. The result of the analysis of

AAS was a calibration curve. From the calibration curve of the analyte concentration of the sample solution it could be sought after the measure of the absorbance. Factors that may affect the calibration process were AAS standard solution and AAS instrument.

2.2.3 Data Analysis

Heavy metal test results of *Anadara granosa* from 10 traditional markets in the city of Semarang, then, were analyzed by using analysis of variance or one–way ANOVA with IBM SPSS 22. This analysis was used to determine differences in the concentration of heavy metals such as Pb, Cd, and Cr in *Anadara granosa* from the 10 traditional markets in the city of Semarang.

3.0 RESULTS AND DISCUSSION

3.1 Lead (Pb)

Lead (Pb) or black tin is a natural substance which is found in the earth's crust and often used in chemical manufactured industries (e.g. batteries industry, stationery industries), electrical wiring and coloring paint. Waste of lead (Pb) often can be found in the form of sediment, which can contaminate the waters and organisms such as shellfish (*Anadara granosa*). Table 1 present results of lead (Pb) analysis of *Anadara granosa* in 10 traditional markets in Semarang.

Table 1 Results of the analysis of *Anadara granosa's* lead (Pb) in 10 traditional markets at Semarang City

No.	Samples code	Lead (mg · kg^{-1})				
		I	II	III	Mean	SD
1	Ps. Pedurungan	0.24	0.23	0.23	0.23	0.01
2	Ps. Genuk	0.22	0.23	0.22	0.22	0.00
3	Ps. Gayamsari	0.20	0.20	0.20	0.20	0.00
4	Ps. Johar	0.18	0.18	0.18	0.18	0.00
5	Ps. Jati	0.17	0.18	0.17	0.17	0.00
6	Ps. Peterongan	0.14	0.15	0.15	0.15	0.00
7	Ps. Boom Lama *	0.11	0.13	0.13	0.12	0.01
8	Ps. Karang ayu *	0.12	0.12	0.11	0.12	0.00
9	Ps.Mangkang	0.10	0.10	0.10	0.10	0.00
10	Ps. Ngaliyan	0.09	0.09	0.09	0.09	0.00

Note: SD= Standard Deviation; *= not significantly different (P>0.01)

Table 1 illustrate lead (Pb) contained in *Anadara granosa* taken from traditional market Pedurungan, Genuk, and Gayamsari were the highest levels among all traditional market. Lead is a substance that is highly toxic or poisonous if absorbed into the body. Lead poisoning can be experienced by people of various ages. Especially in high–risk groups e.g. pregnant women exposed to lead (Pb) could flow through the placenta to the child during pregnancy and lactation. For the fetus to be at risk of micronutrient deficiencies, malnutrition, to the chronically impaired brain development [3]. Lead poisoning are able to influence brain development by reducing the IQ, hyperactivity, hearing damage and impaired the child growth [13]. However, the content of lead (Pb) in the consumption of fishery products at generally northern coastal communities should remain a concern because of the nature of accumulation.

3.2 Chromium (Cr)

Chromium (Cr) is a metal that has been used extensively in human life such as industry, textiles, tanning, and explosives [14]. Chromium waste industrial products generally, are often discharged into waters which contaminate aquatic and organisms such as shellfish. Table 2 illustrate result analysis of chromium of *Anadara granosa* in 10 traditional markets at Semarang city.

Table 2 Results of *Anadara granosa's* chromium (Cr) analysis in 10 traditional markets at Semarang City

No.	Samples code	Chromium (mg ·kg^{-1})				
		I	II	III	Mean	SD
1	Ps. Pedurungan	0.07	0.07	0.07	0.07	0.00
2	Ps. Genuk	0.08	0.08	0.08	0.08	0.00
3	Ps.Gayamsari	0.09	0.09	0.09	0.09	0.00
4	Ps. Johar*	0.06	0.06	0.06	0.06	0.00
5	Ps. Jati*	0.05	0.05	0.05	0.05	0.00
6	Ps. Peterongan*	0.05	0.05	0.05	0.05	0.00
7	Ps. Boom Lama *	0.04	0.04	0.04	0.04	0.00
8	Ps. Karangayu *	0.06	0.06	0.06	0.06	0.00
9	Ps. Mangkang*	0.06	0.06	0.06	0.06	0.00
10	Ps.Ngaliyan*	0.04	0.04	0.04	0.04	0.00

Note: SD= Standard Deviation; * = Different significantly (P<0.05)

Chromium (Cr) is an element that has an important role in everyday life. At low concentrations in the form of $Cr3^+$ (trivalent), chromium is an essential micronutrient for humans [15]. But at high concentrations in the form of $Cr6^+$ (hexavalent), known to be carcinogenic [16]. Chromium in foods mostly found in coral and sea water [15]. The draw of chromium in the form of $Cr3^+$ is in adequate quantities have known its benefits in improving the ability of insulin in glucose metabolism [17]. Even in the treatment of chromium parenteral nutrition became one of the essential nutrients [15]. Nevertheless, the accumulation of the chromium in the tissue must be wary not to form toxic $Cr6^+$ and the long term potential to become cancerous.

3.3 Cadmium (Cd)

Cadmium (Cd) is a toxic heavy metal elements often found in sewage pollution of waters and shellfish other than lead (Pb) [18]. Results of analysis of cadmium (Cd) of *Anadara granosa* in 10 markets in Semarang city is shown in Table 3.

Table 3 Analysis of *Anadara granosa*'s Cadmium (Cd) in 10 traditional markets at Semarang city

No	Samples code	Cadmium (mg · kg^{-1})				
		I	II	III	Mean	SD
1	Ps. Pedurungan	0.09	0.09	0.09	0.09	0.00
2	Ps. Genuk	0.16	0.16	0.16	0.16	0.00
3	Ps. Gayamsari	0.14	0.14	0.14	0.14	0.00
4	Ps. Johar	0.13	0.13	0.13	0.13	0.00
5	Ps. Jati	0.13	0.13	0.13	0.13	0.00
6	Ps. Peterongan	0.10	0.10	0.10	0.10	0.00
7	Ps. Boom Lama	0.09	0.09	0.09	0.09	0.00
8	Ps. Karangayu	0.08	0.08	0.08	0.08	0.00
9	Ps. Mangkang	0.09	0.09	0.09	0.09	0.00
10	Ps. Ngaliyan	0.06	0.06	0.06	0.06	0.00

Note: SD= Standard Deviation; * = Different significantly (P<0.05)

Anadara granosa were obtained from Genuk traditional market containing the highest cadmium (0.16 ± 0.00 mg · kg^{-1}), while the shells obtained from Ngaliyan traditional market containing the lowest cadmium (0.06 ± 0.00 mg · kg^{-1}). Cadmium will be transported by an enzyme transporter, which has trivalent in valency numbering and has a potential reduced as 2^{+} then may accumulate in the kidneys and liver. If the concentration reached 200 µg · g^{-1} or more, it will cause kidney damage. Cadmium metal source can be derived from the metals that may be plated with cadmium. Based on the WHO cadmium consumption threshold is between 57 mg per d to 71 mg per d [19].

In the biochemical process of human body, there are three main mechanisms of how the heavy metal interact and cause a variety of biochemical disturbances [20,21]. The first mechanism is by entering the human body through food intake, through the digestive process, and is absorbed through the intestinal villi to the blood circulation. The second mechanism is after they entry into circulation, there is a trivalent metal receptors, which unrecognized whether it is a metal that is essential or not essential to human body. The effect is there will be a complex competition between essential trace elements against non essential metal [22]. The third mechanism in the long term effect, since imbalanced competition between non essential metal and essential trace elements, may cause essential micronutrients deficiency and functional disorders e.g. child growth and impaired of brain developmental [23].

4.0 CONCLUSION

High level of lead (Pb), chromium (Cr), and cadmium (Cd) are found in *Anadara granosa* taken from 10 traditional markets in the city of Semarang. Based on the criteria of food quality and considering of the characteristics of heavy metals that can accumulate in the human body it is emphasized unfavorable for

consumption in the long term. This study recommends next study to determine the impact of Pb, Cd, and Cr on micronutrients status in human body at coastal area of Semarang city.

Acknowledgement

This study was supported by Ministry of Research, Technology, and Higher Education, Competitive Research Grant Diponegoro University

References

[1] WHO. 2014. Exposure to Lead: A Major Public Health Concern. Preventing Disease Through Healthy Environtments. [Online]. From: http://www.who.int/ipcs/features/lead..pdf. [Accessed on 4 July 2015].
[2] Vallascas, E., De Micco, A., Deiana, F., Banni, S. and Sanna, E. 2013. Adipose Tissue: Another Target Organ for Lead Accumulation? A Study on Sardinian Children (Italy). *Am. J. Hum. Biol*. 25: 789–794.
[3] Wasserman, G. A., Liu, X., Factor–Litvak, P., Gardner, J. M. and Graziano, J. H. 2008. Developmental Impacts of Heavy Metals and Undernutrition. Basic & Clinical Pharmacology & Toxicology. 102: 212–217.
[4] Haslaniza, H., Maskat, M. Y., AIDA, W. and Mamot, S. 2014. Process Development for the Production of Protein Hydrolysate from Cockle (*Anadara granosa*) Meat Wash Water. *Sains Malaysiana*. 43(1): 53–63.
[5] Fischer, A. B., Georgieva, R., Nikolova, V., *et al*. 2003. Health Risk for Children from Lead and Cadmium Near a Non-ferrous Smelter in Bulgaria. *Int. J. Hyg. Environ. Health*. 206: 25–38.
[6] Kavcar, P., Sofuoglu, A. and Sofuoglu, S. C. 2009. A Health Risk Assessment for Exposure to Trace Metas via Drinking Water Ingestion Pathway. *Int. J. Hyg. Environ. Health*. 212: 216–227.
[7] Khan, S., Rehman, S., Khan, A. Z., Khan, A. and Shah, M. T. 2010. Soil and Vegetables Enrichment with Heavy Metals from Geological Sources in Gilgit, Northern Pakistan. *Ecotoxicol. Environ Saf*. 73: 1820–1827.
[8] Mijal, R. S. and Holzman, C. B. 2010. Blood Cadmium Levels in Women of Child Bearing Age Vary by Race/Ethnicity. *Environ. Res*. 110: 505–512.
[9] Zhao, H., Xia, B., Fan, C., Zhao, P. and Shen, S. 2012. Human Health Risk from Soil Heavy Metal Contamination under Different Land uses Near Dabaoshan Mine, Southern China. *Sci. Total Environ*. 417–418: 45–54.
[10] Er, C., Senkal, B. F. and Yaman, M. 2013. Determination of Lead in Milk and Yoghurt Samples by Solid Phase Extraction Using a Novel Aminothioazole–Polymeric *Resin. Food Chem*. 137(1–4): 55–61.
[11] Rainbow, P. S. 2006. Biomonitoring of Trace Metals in Estuarine and Marine Environments. *Aust J Ecotoxicol*. 12: 107–122.
[12] Association of Official Analytical Chemists (AOAC). 1996. Official Methods of Analysis. 16th Edn. Washington DC: AOAC Inc.
[13] Meyer, P. A., Mc. Geehin., M. A. and Falk, H. 2003. A Global Approach to Childhood Lead Poisoning Prevention. *International Journal Hygiene Environmental Health*. 206: 363–369.
[14] Miller-Ihli, N. J. 1992. Chromium, USDA, Nutrient Composition Laboratory. In: Stoepler, M. (Ed). *Hazardous Metals in the Environment*. Germany: Institud Fur Chemie.
[15] Cefalu, W. T. and Hu, F. B. 2004. Role of Chromium in Human Health and in Diabetes. *Diabetes Care*. 27(11): 2741–2751.
[16] Holmes, A. L., Wise, S. S. and Wise Sr, J. P. 2008. Carcinogenicity of Hexavalent Chromium. *Indian Journal of Medical Research*. 128(4): 353–372.
[17] Jeejeebhoy, K. N., Chu, R. C., Marliss, E. B., Greenberg, G. R. and Bruce-Robertson, A. 1977. Chromium Deficiency, Glucose Intolerance, and Neuropathy Reversed by Chromium Supplementation, in a Patient Receiving Long–Term Total Parental Nutrition. *Am J Clin Nutr*. 30: 531–538.
[18] Kwok, C.-K., Liang, Y., Wang, H., Dong, Y.-H., Leung, S.-Y. and Wong, M.-H. 2014. Bioaccumulation of Heavy Metals in Fish and Ardeid at Pearl River Estuary, China. *Ecotoxicology and Environmental Safety*. 106: 62–67.
[19] Needleman, H. L. 2004. Low Level Lead Exposure and the Development of Children. *Southeast Asian Journal of Tropical Medicine and Public Health*. 35: 252–254.
[20] Kordas, K., Lönnerdal, B. and Stoltzfus, R. J. 2007. Interactions between Nutrition and Environmental Exposures: Effects on Health Outcomes in Women and Children. *The Journal of Nutrition*. 137(12): 2794–2797.
[21] Kippler, M., Lönnerdal, B., Goessler, W., Ekström, E. C., El Arifeen, S. and Vahter, M. 2009. Cadmium Interacts with the Transport of Essential Micronutrients in the Mammary Gland – A Study in Rural Bangladeshi Women. *Toxicology*. 257(1): 64–69.
[22] Kim, Y. and Park, S. 2014. Iron Deficiency Increases Blood Concentrations of Neurotoxic Metals in Children. *Korean Journal of Pediatrics*. 57(8): 345–350.
[23] Dorea, J. G., Marques, R. C. and Isejima, C. 2012. Neurodevelopment of Amazonian Infants: Antenatal and Postnatal Exposure to Methyl-and Ethylmercury. *Journal of Biomedicine and Biotechnology*. 2012: 1–9.

Conference / group logo	Conference / group information

BORANG PENILAIAN JURNAL
(EVALUATION FORM FOR *JOURNAL)*

Tajuk artikel : **ANALYSIS OF HEAVY METAL CONTENT IN *ANANDARA GRANOSA*: A CASE STUDY OF 10 MARKETS IN SEMARANG, CENTRAL JAVA, INDONESIA**

(*TITLE*)

Tahun (Year) : __2015_____ No. Fail (Fail No.):

* Tarikh penerimaan : ☐☐ ☐☐ ☐☐☐☐

(*Date of receipt*)

* **Nama penilai** :

(*Referee's name*) Kapti Rahayu Kuswanto, Prof. Dr.

* Alamat penilai : Universitas Slamet Riyadi Surakarta

* No. Tel (*Telephone No.*): 0271- □□□ □□□□□□□□

□□ □□□□□□

(*Address*)

* Alamat E-mel : 1. Kapti_rk@yahoo.com

(*E-mail address*) 2. _____ *Jika ada (If any)

* Tarikh siap : 2- -1 2016 □ □□ □□ □□□□

(*Date of completion*)

Nota (Note) **:** Sila isi pada ruangan yang bertanda * *(Please fill in the required information).*

Komen Penilai (*Referee's Comments*)

___Penelitian sangat sederhana walaupun informasi diperlukan oleh masyarakat. Sebaiknya sebagai "Short Communication "

_____

_____

_____

_____

_____

_____

A. EVALUATIONS

Please evaluate the paper according to the following criteria:

		YES	NO
COMMENTS			
1.	The topic is important and relevant for publication	[v]	[ ]
2.	The work presented in the manuscript is original	[v]	[ ]
3.	The manuscript uses sufficient references	[ ]	[v]
4.	The manuscript uses appropriate language and styles	[ ]	[v]
5.	The title of the manuscript is appropriate	[ ]	[v]
6.	The order of presentation is satisfactory	[v]	[ ]
7.	The abstract adequately summarizes the content of the manuscript	[v]	[ ]

8.	The introduction is adequately developed	[ ]	[v]
9.	The problem described in the manuscript is clearly stated	[ ]	[v]
10.	The adopted methodology described in the manuscript is sound	[v]	[ ]
11.	The findings of this manuscript are correctly interpreted	[ ]	[v]
12.	The manuscript is free from obvious errors	[ ]	[v]
13.	The quality of figures and illustrations is acceptable for publications	[ ]	[v]
14.	The manuscript does not dwell on any sensitive issues	[ ]	[v]

B. **SUGGESTIONS TO THE AUTHOR(S)**

What can the author(s) do to improve the quality of this paper? Please use separate sheets if necessary.

___The author(s) should mention another related publication for correctly interpreted

Standard for Indonesian products should be mention

._____

_____

____

_____

____

C. RECOMMENDATIONS TO THE EDITORS

The manuscript should be:

a. Published as it is.
b. Published with changes as recommended.
c. Returned to the writer to be completely reworked and rewritten.

d. Rejected.

Note: If you selected **b** and **c**, please list all corrections and suggestions in separate sheets. If you have chosen **d**, please include your comments as well**.**

Re: Hasil review naskah Heavy Metal

Dari: Rosita Dwi Chandra,S.TP, M.FoodSt(Adv) (rosita.dwi@machung.ac.id)
Kepada: fronthea_thp@yahoo.co.id
Tanggal: Senin, 18 Januari 2016 08.18 WIB

Yth. Ibu Thea,

Terima kasih untuk review yang sudah Ibu kerjakan.

Saya sudah menyampaikan pada author hasil review tersebut. Mohon untuk Ibu menunggu respon selanjutnya.

Terima kasih.

Salam,

Rosita

From: Fronthea Swastawati <fronthea_thp@yahoo.co.id>
Sent: Friday, January 15, 2016 5:15 PM
To: Rosita Dwi Chandra,S.TP, M.FoodSt(Adv)
Subject: Bls: Hasil review naskah Heavy Metal

Ysh. Mbak Rosita

Berikut saya kirimkan Evaluatian Form For Jurnal a.n Iis Rostini.

Matur Nuwun

Pada Jumat, 15 Januari 2016 16:00, "Rosita Dwi Chandra,S.TP, M.FoodSt(Adv)" <rosita.dwi@machung.ac.id> menulis:

Yth. Ibu Thea,

Kapan Ibu bisa mengirimkan hasil review Ibu Iis Rostini maupun revisi naskah Ibu? Mohon konfirmasinya mengingat waktu submission yang sudah dekat.
Terima kasih untuk perhatian dan kerja sama yang Ibu berikan.

Salam,
Rosita

From: Rosita Dwi Chandra,S.TP, M.FoodSt(Adv)
Sent: Friday, January 8, 2016 2:26 PM
To: Fronthea_thp@yahoo.co.id
Cc: fronthea_thp@undip.ac.id
Subject: Fw: Hasil review naskah Heavy Metal

Yth. Bu Thea,

Saya forward email ini karena sebelumnya tidak terkirim ke email yahoo Ibu.

Terima kasih.

Salam,
Rosita

From: Rosita Dwi Chandra,S.TP, M.FoodSt(Adv)
Sent: Friday, January 8, 2016 2:15 PM
To: Dr fronthea Swastawati
Subject: Re: Hasil review naskah Heavy Metal

Yth. Bu Thea,

Terima kasih untuk informasi yang Ibu berikan. Saya akan tunggu revisi naskah Ibu. Mohon juga untuk Ibu mereview naskah Ibu Iis Rostini yang sudah saya kirim sebelumnya.
Terima kasih untuk perhatian dan kerja sama yang Ibu berikan.

Salam,
Rosita

From: Dr fronthea Swastawati <fronthea_thp@yahoo.com>
Sent: Saturday, January 9, 2016 2:27 AM
To: Rosita Dwi Chandra,S.TP, M.FoodSt(Adv)
Subject: RE: Hasil review naskah Heavy Metal

Ysb Mbak Rosita,
Alhamdulillah saya baru saja kembali ke Tanah Air setelah Ibadah Umroh. Kebetulan data hasil uji lab tambahan baru keluar minggu lalu..insya Allah minggu ini saya olah untuk melengkapi paper dan sekaligus menanggapi masukan dr Prof Kapti..masih ada sekitar 6 tabel hasil perlakuan penelitian kami..tks.
Salam.
Fronthea.

Sent from Samsung Mobile

-------- Original message --------
From: "Rosita Dwi Chandra,S.TP, M.FoodSt(Adv)"
Date:03/01/2016 7:03 PM (GMT-07:00)
To: Fronthea_thp@yahoo.co.id
Cc: fronthea_thp@undip.ac.id,"Monika Nur Utami Prihastyanti, S.TP, M.Nat.Sc"
Subject: Hasil review naskah Heavy Metal

Yth. Ibu Fronthea,

Berikut saya kirimkan hasil review naskah Ibu yang sudah direview oleh Ibu Kapti Rahayu. Saya juga menyampaikan komentar beliau "Sebetulnya saya agak kesulitan karena paper sangat sederhana, yang biasanya hanya dimuat sebagai "Short Communication" beberapa lembar saja".
Mohon untuk Ibu memperbaiki naskah sesuai komentar yang diberikan.
Terima kasih untuk perhatian dan kerja sama yang diberikan.

Salam,
Rosita

Re: Paper Heavy Metal

Dari: adriyan pramono (adriyanpram@gmail.com)

Kepada: fronthea_thp@yahoo.co.id

Tanggal: Jumat, 15 Januari 2016 15.10 WIB

Dear Dr.Fronthea

Bersama ini saya lampirkan hasil modifikasi terhadap paper berdasarkan hasil terbaru. Perubahan yang sy coba susun yang berwarna merah. Ada beberapa poin yang saya beri catatan :

1. Dengan modifikasi paper, maka di dalam pendahuluan ada tambahan 3 referensi yang tertuang dalam narasi paragraf terakhir untuk menyinggung lime dan kumis kucing. Dalam daftar referensi sudah saya tambahkan dan arrange perubahan yang ada.

2. Penentuan konsentrasi dan lama perendaman disebutkan merujuk previous study, namun tidak ada referensinya. Oleh sebab itu dalam narasi di samples preparation saya beri kurung untuk tempat referensi.

3. Pada hasil tambahan setelah analisis data paska diberi lime dan kumis kucing, tidak ada pendukung hasil analisis statistiknya, sehingga saya agak kesulitan menjelaskan kata efektif paska perlakuan, lazimnya diberikan istilah signifikan (....significantly....) namun saya agak ragu mengingat tidak ada p vaue hasil uji beda. Barangkali bisa ditambahkan bu.

Sekian dulu dari saya. Semoga bermanfaat dan paper mendapatkan respon positif.

Terima kasih

Salam,

Adriyan

> Pada 12 Januari 2016 13.18, Fronthea Swastawati <fronthea_thp@yahoo.co.id> menulis:
>
> > Ysh. Pak Adriyan
> >
> > Bersama ini saya lampirkan paper Heavy Metal yang sudah ditambahkan data. Mohon jika berkenan Pak Adriyan bisa mengkoreksi kembali dan mencocokkan dengan yang Pak Adriyan sudah kerjakan. Atas kerjasamanya yang baik saya ucapkan terimakasih.
> >
> > Untuk konsepnya, Penelitian ini dibagi 2 tahap, tahap 1 hanya sebagai informasi bahwa kerang dari 10 pasar tersebut mengandung logam. Penelitian tahap 2 kerang diberi perlakuan perendaman larutan jeruk nipis 20% dan larutan daun kumis kucing 20% selama 60 menit.
> >
> > Salam
> > Fronthea

--
Adriyan Pramono.,SGz.,MSi
School of Nutrition Science, Faculty of Medicine, Diponegoro University
Center of Nutrition Research (CENURE) / cenure.undip.ac.id
Jl.Dr.Sutomo No.18 Semarang 50231
Phone/Fax: 024-8453708
Cell Phone: 62 81326 364 152
Email: adriyanpramono@undip.ac.id / adriyanpram@gmail.com
Web / Blog: adriyanpramono.com / adriyanpramono.blogspot.com

Heavy Metal_Adriyan 15012016.doc
272kB

Jurnal Teknologi

Full Paper

ANALYSIS OF HEAVY METAL CONTENT IN *ANANDARA GRANOSA*: A CASE STUDY OF 10 MARKETS IN SEMARANG, CENTRAL JAVA, INDONESIA

Nanik Heru Suprapti[a], Aziz Nur Bambang[b], Fronthea Swastawati[c], Ahmad Ni'matullah Al Baari[d], Adriyan Pramono[e]

[a]Department of Biology, Faculty of Science and Mathematics, Diponegoro University, Semarang

[b]Utilization Study of Water Resources Program, Department of Fisheries, Faculty of Fisheries and Marine Sciences, Diponegoro University, Semarang

[c]Fishery Products Technology Studies Program, Department of Fisheries, Faculty of Fisheries and Marine Sciences, Diponegoro University, Semarang

[d]Laboratory of Chemistry and Food Nutrition, Faculty of Animal and Agriculture, Diponegoro University, Semarang

[e]Department of Human Nutrition/Centre of Nutrition Research (CENURE), Medical Faculty, Diponegoro University, Semarang

Article history

Received

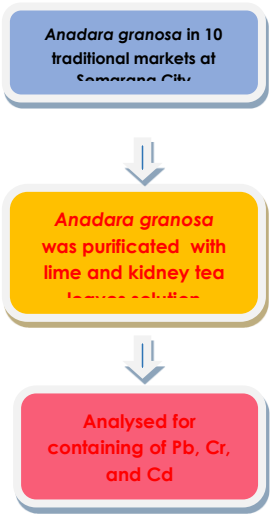
Received in revised form

Accepted

*Corresponding author

fronthea_thp@undip.ac.id

Graphical abstract



Abstract

The purpose of this study was to determine the concentration of heavy metals such as lead (Pb), chromium (Cr), and cadmium (Cd) contained in the shells of *Anadara granosa* taken from 10 markets in the city of Semarang, Central Java, Indonesia (Johar, Genuk, Gayamsari, Teak, Peterongan, Karangayu, Mangkang, Pedurungan, Boom Lama, and Ngaliyan). The concentration of heavy metals of *Anadara granosa* were analyzed using Atomic Absorption Spectrometer (AAS). Analysis of variance (ANOVA) showed that heavy metals (Pb, Cd, and Cr) of shells taken from 10 markets showed a highly significant difference ($P<0.01$) on the content of Pb, showed no significant difference ($P>0.05$) on the content of Cd and Cr. High Pb content of the shells is derived from the shells at Pedurungan market of 0.24 ± 0.01 mg ·kg^{-1}. Levels of *Anadara granosa* that have a high Cr content is derived from the market Gayamsari market 0.09 ± 0.00 mg ·kg^{-1}. While high Cd comes from the shells obtained in the Genuk market of 0.62 ± 0.00 mg ·kg^{-1}. Accumulation of heavy metal contamination such as Pb, Cr, and Cd in shellfish could affect the micronutrient status and consumer health.

Keywords: *Anadara granosa*; heavy metals; micronutrients inhibitor; traditional market of Semarang City

1.0 INTRODUCTION

Heavy metals such as lead (Pb), chromium (Cr), and cadmium (Cd) are toxic contaminants that can cause biochemical changes and bioaccumulation in aquatic and its organisms. Not only adversely affect aquatic organisms, but also for humans who consume metal toxic fish products will also get negatively impacts. For example, heavy metals Pb easier to accumulate in the body of children [1]. The recent study pointed out that the accumulation of Pb is not only in the organs or in the blood, but also in the adipose fat tissue [2]. Pb and Cd poisoning in children can cause to chronic malnutrition due to micronutrients deficiency and impaired brain developmental [3]. Anadara granosa is a fishery products which is able to accumulate heavy metals. *Anadara granosa* is one type of shellfish that have the potential and economic value to be developed, as a source of protein and essential minerals to meet the nutrient adequacy in public health situation. *Anadara granosa* are an infauna, which is life in a way to immerse them selves in the mud, beneath the surface in shallow water [4]. The accumulation of Pb, Cr, and Cd in *Anadara granosa* through human consumption can be detrimental to health problem such as decreased renal function, memory loss, respiratory tract disorders, impaired liver function, and cancer [5–10].

The accumulation of Pb, Cr, and Cd inside the *Anadara granosa* is caused due to the nature or way of life, settle and obtain their food by means of "filter feeders" that can accumulate metals above their own environment. In addition, due to differences in substrate where life and the life of older shells also allows of metals accumulate more than younger shells [11]. Study in rats showed that *Citrus aurantifolia* (Lime) reduced

blood lead levels [12]. *Citrus aurantifolia* (Lime) contains antioxidants and some studies have confirmed such antioxidants could prevent metal toxicities [13,14].

The purpose of this study was to evaluate Pb, Cr, and Cd levels inside the *Anadara granosa* and to investigate the effect of submersion using *Citrus aurantifolia* (Lime) and *Orthosiphon aristatus* (Kidney tea leaves) juice on Pb, Cd, and Cr levels of Anadara granosa.

2.0 EXPERIMENTAL

2.1 Material Research

Materials used in this study are shells of *Anadara granosa* taken from 10 traditional markets mentioned above as each 1 kg of shells from every market with the size 3 cm to 5 cm and weight of 10 g. Samples were taken using a plastic bag, camera, label, box sterofoam.

2.2 Research Methods

This study was conducted in two stages. The first stage was determined to asses Pb, Cd, dan Cr levels in Anadara granosa (samples were taken from 10 traditional market in Semarang, Indonesia). The second stage was to investigate the effect of liquid *Citrus aurantifolia* (Lime) and *Orthosiphon aristatus* on Pb, Cd, and Cr levels of Anadara granosa.

2.2.1 Sampling of the Shells

About 500 g sample was taken directly from the traditional markets located in Semarang. The sample is then washed to remove dirt and then boiled to separte the shells and shellfish meat.

2.2.2 Sample preparations

A 50 grams samples were deluged iinside of *Citrus aurantifolia* (Lime) and *Orthosiphon aristatus* (Kidney tea leaves) juice with 20 % concentrate during sixty minutes. Concentration and time of submersion were determined using previous study [pustakanya mana], with concentration of 10 %, 15 %, 20 % dan 25 % and time of submersion of thirty minute, sixty minutes and ninety minutes.

2.2.3 Testing of Heavy Metals by Atomic Absorption Spectrometer [15]

About 50 g sample is taken and then dried at a temperature of approximately 100 ˚C, then mashed into a form such as powder. Samples were dissolved into the vessel of 500 mg and was added nitric acid and perchloric acid in 1 mL and 2.5 mL of distilled water. Then the sample was put in a microwave digestion. Subsequently, the samples were analyzed using Atomic Absorption Spectroscopy (AAS). The working of this method was done by comparing the absorbance of the sample solution with the standard solution comparator to obtain the concentration of sample. Scale absorbance of AAS was calibrated with a standard series of known concentration. The result of the analysis of AAS was a calibration curve. From the calibration curve of the analyte concentration of the sample solution it could be sought after the measure of the absorbance. Factors that may affect the calibration process were AAS standard solution and AAS instrument.

2.2.4 Data Analysis

Heavy metal test results of *Anadara granosa* from 10 traditional markets in the city of Semarang, then, were analyzed by using analysis of variance or one–way ANOVA with IBM SPSS 22. This analysis was used to determine differences in the concentration of heavy metals such as Pb, Cd, and Cr in *Anadara granosa* from the 10 traditional markets in the city of Semarang.

3.0 RESULTS AND DISCUSSION

3.1 Lead (Pb)

Lead (Pb) or black tin is a natural substance which is found in the earth's crust and often used in chemical manufactured industries (e.g. batteries industry, stationery industries), electrical wiring and coloring paint. Waste of lead (Pb) often can be found in the form of sediment, which can contaminate the waters and organisms such as shellfish (*Anadara granosa*). Table 1 present results of lead (Pb) analysis of *Anadara granosa* in 10 traditional markets in Semarang.

Table 1 Results of the analysis of *Anadara granosa*'s lead (Pb) in 10 traditional markets at Semarang City

No.	Samples code	Lead (mg · kg^{-1})				
		I	II	III	Mean	SD
1	Ps. Pedurungan	0.24	0.23	0.23	0.23	0.01
2	Ps. Genuk	0.22	0.23	0.22	0.22	0.00
3	Ps. Gayamsari	0.20	0.20	0.20	0.20	0.00
4	Ps. Johar	0.18	0.18	0.18	0.18	0.00
5	Ps. Jati	0.17	0.18	0.17	0.17	0.00
6	Ps. Peterongan	0.14	0.15	0.15	0.15	0.00
7	Ps. Boom Lama *	0.11	0.13	0.13	0.12	0.01
8	Ps. Karang ayu *	0.12	0.12	0.11	0.12	0.00
9	Ps.Mangkang	0.10	0.10	0.10	0.10	0.00
10	Ps. Ngaliyan	0.09	0.09	0.09	0.09	0.00

Note: SD= Standard Deviation; *= not significantly different (P>0.01)

Table 1 illustrate lead (Pb) contained in *Anadara granosa* taken from traditional market Pedurungan, Genuk, and Gayamsari were the highest levels among all traditional market. Lead is a substance that is highly toxic or poisonous if absorbed into the body. Lead poisoning can be experienced by people of various ages. Especially in high–risk groups e.g. pregnant women exposed to lead (Pb) could flow through the placenta to the child during pregnancy and lactation. For the fetus to be at risk of micronutrient deficiencies, malnutrition, to the chronically impaired brain development [3]. Lead poisoning are able to influence brain development by reducing the IQ, hyperactivity, hearing damage and impaired the child growth [16]. However, the content of lead (Pb) in the consumption of fishery products at generally northern coastal communities should remain a concern because of the nature of accumulation.

3.2 Chromium (Cr)

Chromium (Cr) is a metal that has been used extensively in human life such as industry, textiles, tanning, and explosives [17]. Chromium waste industrial products generally, are often discharged into waters which contaminate aquatic and organisms such as shellfish. Table 2 illustrate result analysis of chromium of *Anadara granosa* in 10 traditional markets at Semarang city.

Table 2 Results of *Anadara granosa's* chromium (Cr) analysis in 10 traditional markets at Semarang City

No.	Samples code	Chromium (mg ·kg⁻¹)				
		I	II	III	Mean	SD
1	Ps. Pedurungan	0.07	0.07	0.07	0.07	0.00
2	Ps. Genuk	0.08	0.08	0.08	0.08	0.00
3	Ps.Gayamsari	0.09	0.09	0.09	0.09	0.00
4	Ps. Johar*	0.06	0.06	0.06	0.06	0.00
5	Ps. Jati*	0.05	0.05	0.05	0.05	0.00
6	Ps. Peterongan*	0.05	0.05	0.05	0.05	0.00
7	Ps. Boom Lama *	0.04	0.04	0.04	0.04	0.00
8	Ps. Karangayu *	0.06	0.06	0.06	0.06	0.00
9	Ps. Mangkang*	0.06	0.06	0.06	0.06	0.00
10	Ps.Ngaliyan*	0.04	0.04	0.04	0.04	0.00

Note: SD= Standard Deviation; * = Different significantly (P<0.05)

Chromium (Cr) is an element that has an important role in everyday life. At low concentrations in the form of $Cr3^+$ (trivalent), chromium is an essential micronutrient for humans [18]. But at high concentrations in the form of $Cr6^+$ (hexavalent), known to be carcinogenic [19]. Chromium in foods mostly found in coral and sea water [18]. The draw of chromium in the form of $Cr3^+$ is in adequate quantities have known its benefits in improving the ability of insulin in glucose metabolism [20]. Even in the treatment of chromium parenteral nutrition became one of the essential nutrients [18]. Nevertheless, the accumulation of the chromium in the tissue must be wary not to form toxic $Cr6^+$ and the long term potential to become cancerous.

3.3 Cadmium (Cd)

Cadmium (Cd) is a toxic heavy metal elements often found in sewage pollution of waters and shellfish other than lead (Pb) [21]. Results of analysis of cadmium (Cd) of *Anadara granosa* in 10 markets in Semarang city is shown in Table 3.

Table 3 Analysis of *Anadara granosa*'s Cadmium (Cd) in 10 traditional markets at Semarang city

No	Samples code	Cadmium (mg ·kg⁻¹)				
		I	II	III	Mean	SD
1	Ps. Pedurungan	0.09	0.09	0.09	0.09	0.00
2	Ps. Genuk	0.16	0.16	0.16	0.16	0.00

3	Ps. Gayamsari	0.14	0.14	0.14	0.14	0.00
4	Ps. Johar	0.13	0.13	0.13	0.13	0.00
5	Ps. Jati	0.13	0.13	0.13	0.13	0.00
6	Ps. Peterongan	0.10	0.10	0.10	0.10	0.00
7	Ps. Boom Lama	0.09	0.09	0.09	0.09	0.00
8	Ps. Karangayu	0.08	0.08	0.08	0.08	0.00
9	Ps. Mangkang	0.09	0.09	0.09	0.09	0.00
10	Ps. Ngaliyan	0.06	0.06	0.06	0.06	0.00

Note: SD= Standard Deviation; * = Different significantly (P<0.05)

Anadara granosa were obtained from Genuk traditional market containing the highest cadmium (0.16 ± 0.00 mg · kg^{-1}), while the shells obtained from Ngaliyan traditional market containing the lowest cadmium (0.06 ± 0.00 mg · kg^{-1}). Cadmium will be transported by an enzyme transporter, which has trivalent in valency numbering and has a potential reduced as 2^{+} then may accumulate in the kidneys and liver. If the concentration reached 200 µg · g^{-1} or more, it will cause kidney damage. Cadmium metal source can be derived from the metals that may be plated with cadmium. Based on the WHO cadmium consumption threshold is between 57 mg per d to 71 mg per d [22].

In the biochemical process of human body, there are three main mechanisms of how the heavy metal interact and cause a variety of biochemical disturbances [23,24]. The first mechanism is by entering the human body through food intake, through the digestive process, and is absorbed through the intestinal villi to the blood circulation. The second mechanism is after they entry into circulation, there is a trivalent metal receptors, which unrecognized whether it is a metal that is essential or not essential to human body. The effect is there will be a complex competition between essential trace elements against non essential metal [25]. The third mechanism in the long term effect, since imbalanced competition between non essential metal and essential trace elements, may cause essential micronutrients deficiency and functional disorders e.g. child growth and impaired of brain developmental [26].

3.4. Lead, Cadmium, and Chromium Levels after purification using *Citrus aurantifolia* (Lime) and *Orthosiphon aristatus* (Kidney tea leaves) juice

3.4.1 Lead (Pb)

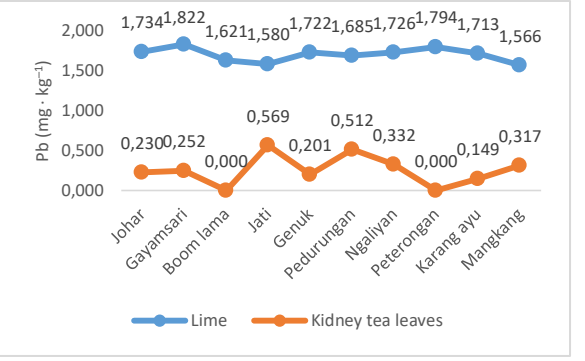


Figure 1 Results of the analysis of *Anadara granosa*'s lead (Pb) in 10 traditional markets at Semarang City after purification

Figure 1 depicted decreasing of lead in Anadara granosa after purification with *Citrus aurantifolia* (Lime) and *Orthosiphon aristatus* (Kidney tea leaves) juice. Submersion using *Orthosiphon aristatus* (Kidney tea leaves) showed reduction of lead concentration significantly compared to *Citrus aurantifolia* (Lime) solution. Azelee et al (2014), the permissible levels of Pb set by the Commission Regulation of EU (2006) for human consumption was 1.00 µg. g^{-1} or 1.00 ppm.

3.4.2 Chromium (Cr)

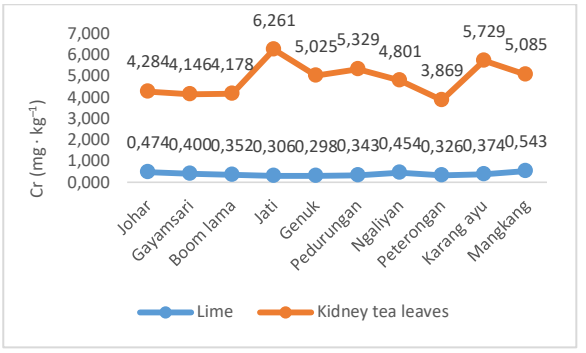


Figure 2 Results of the analysis of *Anadara granosa*'s chromium (Cr) in 10 traditional markets at Semarang City after purification

The submersion using *Citrus aurantifolia* (Lime) decreased Chromium of Anadara granosa significantly compared to *Orthosiphon aristatus* (Kidney tea leaves).

3.4.3 Cadmium (Cd)

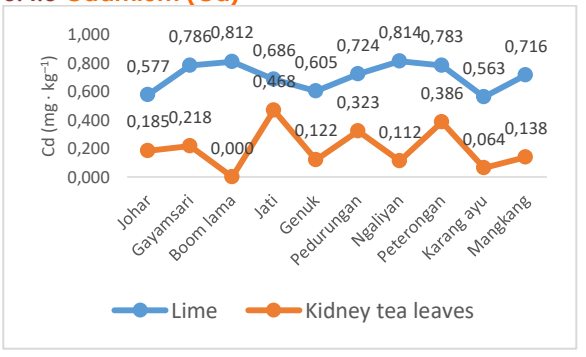


Figure 3 Results of the analysis of *Anadara granosa*'s Cadmium (Cd) in 10 traditional markets at Semarang City after purification

Figure 3 showed *Orthosiphon aristatus* (Kidney tea leaves) juice reduced Cadmium (Cd) levels of Anadara granosa significantly compared to *Citrus aurantifolia* (Lime) juice.

4.0 CONCLUSION

High level of lead (Pb), chromium (Cr), and cadmium (Cd) are found in *Anadara granosa* taken from 10 traditional markets in the city of Semarang. Based on the criteria of food quality and considering of the characteristics of heavy metals that can accumulate in the human body it is emphasized unfavorable for consumption in the long term. This study recommends dissolution using *Citrus aurantifolia* (Lime) and *Orthosiphon aristatus* (Kidney tea leaves) could be done at food processing to reduce Pb, Cd, and Cr of Anadara granosa.

Acknowledgement

This study was supported by Ministry of Research, Technology, and Higher Education, Competitive Research Grant Diponegoro University

References

[1] WHO. 2014. Exposure to Lead: A Major Public Health Concern. Preventing Disease Through Healthy Environtments. [Online]. From: http://www.who.int/ipcs/features/lead..pdf. [Accessed on 4 July 2015].

[2] Vallascas, E., De Micco, A., Deiana, F., Banni, S. and Sanna, E. 2013. Adipose Tissue: Another Target Organ for Lead Accumulation? A Study on Sardinian Children (Italy). *Am. J. Hum. Biol*. 25: 789–794.

[3] Wasserman, G. A., Liu, X., Factor–Litvak, P., Gardner, J. M. and Graziano, J. H. 2008. Developmental Impacts of Heavy Metals and Undernutrition. Basic & Clinical Pharmacology & Toxicology. 102: 212–217.

[4] Haslaniza, H., Maskat, M. Y., AIDA, W. and Mamot, S. 2014. Process Development for the Production of Protein Hydrolysate from Cockle (*Anadara granosa*) Meat Wash Water. *Sains Malaysiana*. 43(1): 53–63.

[5] Fischer, A. B., Georgieva, R., Nikolova, V., *et al*. 2003. Health Risk for Children from Lead and Cadmium Near a Non-ferrous Smelter in Bulgaria. *Int. J. Hyg. Environ. Health*. 206: 25–38.

[6] Kavcar, P., Sofuoglu, A. and Sofuoglu, S. C. 2009. A Health Risk Assessment for Exposure to Trace Metas via Drinking Water Ingestion Pathway. *Int. J. Hyg. Environ. Health*. 212: 216–227.

[7] Khan, S., Rehman, S., Khan, A. Z., Khan, A. and Shah, M. T. 2010. Soil and Vegetables Enrichment with Heavy Metals from Geological Sources in Gilgit, Northern Pakistan. *Ecotoxicol. Environ Saf.* 73: 1820–1827.

[8] Mijal, R. S. and Holzman, C. B. 2010. Blood Cadmium Levels in Women of Child Bearing Age Vary by Race/Ethnicity. *Environ. Res*. 110: 505–512.

[9] Zhao, H., Xia, B., Fan, C., Zhao, P. and Shen, S. 2012. Human Health Risk from Soil Heavy Metal Contamination under Different Land uses Near Dabaoshan Mine, Southern China. *Sci. Total Environ*. 417–418: 45–54.

[10] Er, C., Senkal, B. F. and Yaman, M. 2013. Determination of Lead in Milk and Yoghurt Samples by Solid Phase Extraction Using a Novel Aminothioazole–Polymeric *Resin. Food Chem*. 137(1–4): 55–61.

[11] Rainbow, P. S. 2006. Biomonitoring of Trace Metals in Estuarine and Marine Environments. *Aust J Ecotoxicol*. 12: 107–122.

[12] Aprioku, J.S., Obianime, A.W, 2014. Evaluation of the Effects of *Citrus aurantifolia* (Lime) Juice in Lead-induced Hematological and Testicular Toxicity in Rats. Pharmacologia, 5: 36-41.

[13] Shrestha, R.L., D.D. Dhakal, D.M. Gautum, K.P. Paudyal and S. Shrestha, 2012. Variation of physiochemical components of acid lime (*Citrus aurantifolia* swingle) fruits at different sides of the tree in Nepal. *Am. J. Plant Sci.*, 3: 1688-1692

[14] Ayinde, O.C., S. Ogunnowo and R.A. Ogedegbe, 2012. Influence of vitamin C and vitamin E on testicular zinc content and testicular toxicity in lead exposed albino rats. BMC Pharmacol. Toxicol., Vol. 13.

[15] Association of Official Analytical Chemists (AOAC). 1996. Official Methods of Analysis. 16th Edn. Washington DC: AOAC Inc.

[16] Meyer, P. A., Mc. Geehin., M. A. and Falk, H. 2003. A Global Approach to Childhood Lead Poisoning Prevention. *International Journal Hygiene Environmental Health*. 206: 363–369.

[17] Miller-Ihli, N. J. 1992. Chromium, USDA, Nutrient Composition Laboratory. In: Stoepler, M. (Ed). *Hazardous Metals in the Environment*. Germany: Institud Fur Chemie.

[18] Cefalu, W. T. and Hu, F. B. 2004. Role of Chromium in Human Health and in Diabetes. *Diabetes Care*. 27(11): 2741–2751.

[19] Holmes, A. L., Wise, S. S. and Wise Sr, J. P. 2008. Carcinogenicity of Hexavalent Chromium. *Indian Journal of Medical Research*. 128(4): 353–372.

[20] Jeejeebhoy, K. N., Chu, R. C., Marliss, E. B., Greenberg, G. R. and Bruce-Robertson, A. 1977. Chromium Deficiency, Glucose Intolerance, and Neuropathy Reversed by Chromium Supplementation, in a Patient Receiving Long–Term Total Parental Nutrition. *Am J Clin Nutr*. 30: 531–538.

[21] Kwok, C.-K., Liang, Y., Wang, H., Dong, Y.-H., Leung, S.-Y. and Wong, M.-H. 2014. Bioaccumulation of Heavy Metals in Fish and Ardeid at Pearl River Estuary, China. *Ecotoxicology and Environmental Safety*. 106: 62–67.

[22] Needleman, H. L. 2004. Low Level Lead Exposure and the Development of Children. *Southeast Asian Journal of Tropical Medicine and Public Health*. 35: 252–254.

[23] Kordas, K., Lönnerdal, B. and Stoltzfus, R. J. 2007. Interactions between Nutrition and Environmental Exposures: Effects on Health Outcomes in Women and Children. *The Journal of Nutrition*. 137(12): 2794–2797.

[24] Kippler, M., Lönnerdal, B., Goessler, W., Ekström, E. C., El Arifeen, S. and Vahter, M. 2009. Cadmium Interacts with the Transport of Essential Micronutrients in the Mammary Gland – A Study in Rural Bangladeshi Women. *Toxicology*. 257(1): 64–69.

[25] Kim, Y. and Park, S. 2014. Iron Deficiency Increases Blood Concentrations of Neurotoxic Metals in Children. *Korean Journal of Pediatrics*. 57(8): 345–350.

[26] Dorea, J. G., Marques, R. C. and Isejima, C. 2012. Neurodevelopment of Amazonian Infants: Antenatal and Postnatal Exposure to Methyl-and Ethylmercury. *Journal of Biomedicine and Biotechnology*. 2012: 1–9.

Re: Naskah untuk direview Ibu Thea (Sarjito)

Dari: Rosita Dwi Chandra,S.TP, M.FoodSt(Adv) (rosita.dwi@machung.ac.id)
Kepada: fronthea_thp@yahoo.co.id
Cc: fronthea_thp@undip.ac.id; fronthea_thp@yahoo.com
Tanggal: Kamis, 4 Februari 2016 15.10 WIB

Yth. Ibu Thea,

Paper Ibu yang terakhir dikirim kemarin sudah saya kirimkan ke Bu Kapti Rahayu karena saya pikir Ibu sudah menyertakan semua data yang diperlukan. Tapi menurut saya tidak apa bila masih ada data yang menyusul setidaknya Ibu tahu bagian mana yang harus diperbaiki dan bagaimana harus menulis data yang menyusul tersebut. Dengan harapan tidak banyak revisi berikutnya.
Demikian yang dapat saya sampaikan. Terima kasih.

Salam,
Rosita

From: Rosita Dwi Chandra,S.TP, M.FoodSt(Adv)
Sent: Thursday, February 4, 2016 3:07 PM
To: Dr fronthea Swastawati
Subject: Re: Naskah untuk direview Ibu Thea (Sarjito)

Yth. Ibu Thea,

Paper Ibu yang terakhir dikirim kemarin sudah saya kirimkan ke Bu Kapti Rahayu karena saya pikir Ibu sudah menyertakan semua data yang diperlukan. Tapi menurut saya tidak apa bila masih ada data yang menyusul setidaknya Ibu tahu bagian mana yang harus diperbaiki dan bagaimana harus menulis data yang menyusul tersebut. Dengan harapan tidak banyak revisi berikutnya.
Demikian yang dapat saya sampaikan. Terima kasih.

Salam,
Rosita

From: Dr fronthea Swastawati <fronthea_thp@yahoo.com>
Sent: Friday, February 5, 2016 4:10 AM
To: Rosita Dwi Chandra,S.TP, M.FoodSt(Adv)
Subject: Re: Naskah untuk direview Ibu Thea (Sarjito)

Mbak Rosita ysb,
Mohon ma'af untuk paper a.n. Bu Nanik Heru memang belum selesai sebenarnya Mbak...krn beliau sakit shg kami diminta membantu..masih ada parameter uji yg baru kami kerjakan di lab...semoga masih bisa diperbaiki.
Penulisannyapun kami akui masih banyak kekurangan..
Demikian Mbak..
Salam..
Thea.

Sent from Samsung Mobile

-------- Original message --------
From: "Rosita Dwi Chandra,S.TP, M.FoodSt(Adv)"
Date:03/02/2016 7:23 PM (GMT-07:00)

To: Fronthea Swastawati
Subject: Re: Naskah untuk direview Ibu Thea (Sarjito)

Terima kasih, Bu.

Salam,
Rosita

From: Fronthea Swastawati <fronthea_thp@yahoo.co.id>
Sent: Thursday, February 4, 2016 9:15 AM
To: Rosita Dwi Chandra,S.TP, M.FoodSt(Adv)
Subject: Bls: Naskah untuk direview Ibu Thea (Sarjito)

Ysb. Mbak Rosita

Iya Mbak Rosita terima kasih , paper sudah saya terima, akan saya review.

Salam

Fronthea

Pada Kamis, 4 Februari 2016 8:55, "Rosita Dwi Chandra,S.TP, M.FoodSt(Adv)" <rosita.dwi@machung.ac.id> menulis:

Yth. Ibu Thea,

Bersama ini saya mengirimkan 1 naskah a.n. Sarjito untuk Ibu review. Mohon maaf karena baru mengirimkan naskah tersebut. Sebelumnya saya sudah mengirimkan naskah tersebut ke 2 reviewer materi yaitu Bapak Murwantoko (21 December 2015) dan Ibu Tita Elfitasari (19 Januari 2016) tetapi beliau tampaknya tidak dapat mereview naskah tersebut karena kesibukan. Oleh karena itu, saya mohon Ibu berkenan untuk mereview naskah tersebut mengingat tenggat waktu yang sudah sangat dekat. Mohon konfirmasi kesediaan Ibu.

Berkenaan dengan naskah Ibu, saya sudah mengirimkan naskah tersebut ke Bu Kapti Rahayu tapi masih belum ada respon. Semoga beliau dapat secepatnya mengoreksi naskah Ibu.

Terima kasih untuk perhatian dan kerja sama yang Ibu berikan.

Salam,
Rosita

Tanggapan para author dan MB

Dari: laras rianingsih (laras_rianingsih@yahoo.com)

Kepada: roy_hendroko@hotmail.com

Cc: monika.nur@machung.ac.id; fronthea_thp@yahoo.co.id; rinadesrina@yahoo.com; apri_anggo@yahoo.com; lukita_anandito@yahoo.com; eco_z13@yahoo.com

Tanggal: Kamis, 11 Februari 2016 11.12 WIB

Yth Pak Roy

Berikut saya lampirkan resume tanggapan para author dan MB terkait dengan email panitia Isaprosh tadi malam. Semoga dapat membantu kelancaran proses. Terimakasih.

Salam
Laras

Reminder naskah macet.xlsx
14.6kB

STATUS NA

Akan direminder oleh tim Ma Chung
Macet di author
Macet di MB materi

No	Nama 1st Author * corresponding author	Institusi	Email	No HP
1	Eko Nurcahya Dewi Retno Ayu Kurniasih*	UNDIP	retno_ayuspi@yahoo.com	08122810535
2	Tita Elfitasari	UNDIP	t.elfitasari@undip.ac.id	081229277111
3	Norma Afiati	UNDIP	08122819625	normaafiati@yahoo.com normaafiati.na@gmail.com
4	Rohula Utami	Universitas Sebelas Maret Surakarta	rohula_utami@yahoo.com	
5	Niken Palupi	Universitas Jember	niken.ftp.unej@gmail.com niken.palupi@mail.ugm.ac.id niken_05@yahoo.com	0811354075
6	Istiyanto	UNDIP	istiyanto_samidjan@yahoo.com	081390713299

7	Mayanggita Indah Susilowati*	UNDIP	kiranamayanggita@gmail.com	087832299488 082133221155
8	Joice Loupatty	Univ Pattimura	loupatty_joice@yahoo.com	085243220216
9	Mala Nurimala	IPB	mnurilmala@ipb.ac.id	081319219286
10	Dedi Edwin Satriaji	UNDIP	dediedwinsatriaji@gmail.com dediedwin.s20@gmail.com	085717716626
11	Delianis Pringgenis Ragil Susilowati*	UNDIP	susilowati_ragil@yahoo.com	081390380660
12	Nanik Heru Fronthea Swastawati*	UNDIP	fronthea_thp@undip.ac.id fronthea_thp@yahoo.co.id	081225191989
13	Shifa Helena	UNDIP	shifa.helena@gmail.com helenashifa31@gmail.com	085742202010
14	Arham Rusli	Poltek Negeri Pertanian Pangkep	a_rusli06@yahoo.com arhamtphppoltek97@gmail.com	081343629722
15	Tri Winarni Agustini	UNDIP	tagustini@yahoo.com	081390653646
16	Hermin Pancasakti	UNDIP	herminpk@undip.ac.id herminsakti@gmail.com gandasakti@yahoo.com	081325874805

ıSKAH "MACET" DI PROSES KOREKSI & REVISI MATERI

Judul	Keterangan	Status	MB template
Antioxidative Activities of Phycocyanin Microcapsules Using Maltodextrin and Carrageenan as a Wall Materials	proses koreksi materi	di author	Katrin
Constraints and Problems Encountered by Small Scale Fish Farmers in Assuring Fish Product Sustainability in Central Java, Indonesia	proses koreksi materi dan template	di author dan MB materi	Katrin
	proses koreksi template	di author	Katrin
Cassava Starch-Based Edible Coatings Enriched with Alpinia purpurata and Kaempferia rotunda Essential Oils for Patin Fillets Preservation	proses koreksi materi	MB materi	Katrin
RELATIONSHIP ANTIOXIDANT CONCENTRATION AND VOLUME HEADSPACE ON THE RANCIDITY OF FISH OIL DURING STORAGE	proses koreksi materi AUTHOR SLOW RESPONSE!!	di author	Katrin
Innovative Polyculture Technology Of White Shrimp (Litopenaeus Vannamei) And Milkfish (Chanos Chanos Forskal) Using Artificial Feed On The Growth And Survival	proses revisi template ke 2 proses revisi materi ke 1 author SLOW RESPOND!	di author	Monika

INNOVATION OF RENEWABLE RESOURCES MANAGEMENT FOR VULNERABLE FISHERIES USING ECOSYSTEM-BASED FISHERIES MANAGEMENT APPROACH : WITH TEST CASE IN KARIMUNJAWA – CENTRAL	proses koreksi materi AUTHOR SLOW RESPONSE!!	di author	Rosita
The Effect of Different Natural Foods Feeding to Growth and Maturity Rate of Broodstock of Abalone Haliotis squamata	proses revisi materi AUHTOR SLOW RESPONSE!!	di author	Rosita
DNA BARCODING FOR IDENTIFICATION OF PROCESSED TUNA FISH in INDONESIA	proses koreksi materi	di author	Katrin
STUDY OF GROWTH AND C, N, P CONTENT OF MICROALGAE CHLORELLA SP. CULTIVATED IN DIFFERENT CULTURE MEDIA AND LIGHT INTENSITY	proses koreksi materi AUTHOR SLOW RESPONSE!!	di author	Monika
HIGHLY COMMERCIAL FISHERIES IKAN TAWAR: MOLECULAR ANALYSIS DNA MITOCHONDRIAL COI GENE SEQUENCE AND PROXIMATE ANALYSIS FROM MALACCA STRAIT, RIAU.	proses koreksi materi	di author	Katrin
Analysis of Heavy Metal Content in Anadara granosa : (A Case Study of 10 markets in Semarang, Central Java, Indonesia	proses koreksi materi	di MB materi	Rosita
Microalgae Dunaliella salina Growth Using the LED Light (Light Emitting Dioda) and Different Media Types	proses koreksi materi	di MB materi	Rosita
ANALYSIS OF ANTIMICROBIAL COMPOUNDS OF SEAWEED FROM MAKASSAR STRAIT, INDONESIA	proses koreksi materi	di MB materi	Monika
Application of S. platensis on soft cheese and ice cream with respect to their nutritional and sensory perspective	proses koreksi materi	di MB materi	Monika
Quantitative Characterization of Dunaliella salina and Chlorella vulgaris Fusant using 18SrDNA Gene	proses koreksi materi	di MB materi	Monika

MB Materi				
Amir Husni	a-husni@ugm.ac.id	085743255664		END
Fandy Tjiptono	fandy.tjiptono@monash.edu			Fandi/tita
Mulyono S. Baskoro	baskoro.mul@gmail.com baskoro_mul@yahoo.com	08128390013		Norma
Tri Winarni Agustini	tagustini@yahoo.com	081390653646		TWA
Tri Winarni Agustini	tagustini@yahoo.com	081390653646		Niken
Anggi	angginindita@yahoo.com	081317723381	**macet di author**	Istiyanto

Fandy Tjiptono	fandy.tjiptono@monash.edu		**macet di author**	Indah
Desrina	rinadesrina@yahoo.com	085713986194	**macet di author**	Joice
Retno Murwani	rmurwani@gmail.com	08122832502	**macet di author (tapi naskah memang baru dikirim ke author tanggal 9 Feb)**	Mala
Bintal Amin	b_amin63@yahoo.com	0811761635	**macet di author**	Dedy
Noverita	veri641@gmail.com	081 110 1630	**macet di author (tapi naskah memang baru dikirim ke author tanggal 9 Feb)**	Ragil
Kapti Rahayu	kapti_rk@yahoo.com	0811267294	**macet di MB materi**	Kapti
Bintal Amin	b_amin63@yahoo.com	0811761635	**macet di MB materi**	Bintal
Desrina	rinadesrina@yahoo.com	085713986194	**macet di MB materi**	Desrina
Harsi Kusumaningrum	harsikusumaningrum@yahoo.com	081311210180	**macet di MB materi**	Harsi
Harsi Kusumaningrum	harsikusumaningrum@yahoo.com	081311210180	**macet di MB materi**	Harsi

		Hari ini akan email hasil revisian
		belum bisa dihubungi
		akan segera mengemailkan revisian
	Monika	MB sudah mengirim ke mb Monik beberapa waktu yang lalu
		tgl 12 siap mengirim revisian
		minggu ini mengirim revisian

		sudah dilakukan pendekatan pribadi oleh Bu Tri
		ybs sedang terkena musibah, suami meninggal tetapi berupaya minggu ini mengirimkar
		tgl 12 siap mengirim revisian
		minggu ini mengirim revisian
		belum bisa dihubungi
Rosita		MB sudah mengirimkan hasil review dan Bu Thea sudah berkomunikasi dengan mb Rosita
		sudah mengemailkan hasil review beberapa waktu yang lalu
Sudah		MB sudah mengirim ke mb Monik beberapa waktu yang lalu
		MB sudah mengirim ke mb Monik tadi pagi
		MB sudah mengirim ke mb Monik tadi pagi

Final check naskah Bu Thea (heavy metal)

Dari: Rosita Dwi Chandra,S.TP, M.FoodSt(Adv) (rosita.dwi@machung.ac.id)

Kepada: roy_hendroko@hotmail.com; fronthea_thp@undip.ac.id; fronthea_thp@yahoo.co.id; fronthea_thp@yahoo.com

Cc: monika.nur@machung.ac.id

Tanggal: Senin, 22 Februari 2016 21.41 WIB

Yth. Pak Roy,

Berikut saya kirimkan naskah Bu Thea untuk diproses final check. Mohon berkenan untuk mengecek naskah tersebut. Terima kasih.

Salam,
Rosita

Heavy Metal_22.2.16 (Final Check).doc
1.2MB

Jurnal

Teknologi

Full Paper

ANALYSIS OF HEAVY METAL CONTENT IN *ANANDARA GRANOSA*: A CASE STUDY OF 10 MARKETS IN SEMARANG, CENTRAL JAVA, INDONESIA

Nanik Heru Suprapti[a], Aziz Nur Bambang[b], Fronthea Swastawati[c], Ahmad Ni'matullah Al Baari[d], Adriyan Pramono[e]

[a]Department of Biology, Faculty of Science and Mathematics, Diponegoro University, Semarang

[b]Utilization Study of Water Resources Program, Department of Fisheries, Faculty of Fisheries and Marine Sciences, Diponegoro University, Semarang

[c]Fishery Products Technology Studies Program, Department of Fisheries, Faculty of Fisheries and Marine Sciences, Diponegoro University, Semarang

[d]Laboratory of Chemistry and Food Nutrition, Faculty of Animal and Agriculture, Diponegoro University, Semarang

[e]Department of Human Nutrition/Centre of Nutrition Research (CENURE), Medical Faculty, Diponegoro University, Semarang

Article history

Received

6 November 2016

Received in revised form

12 February 2016

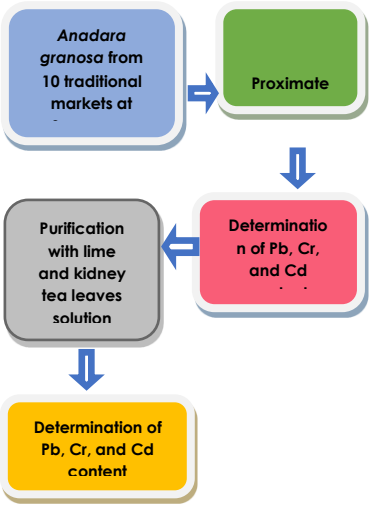
Accepted

*Corresponding author

fronthea_thp@yahoo.co.id

Phone:

Graphical abstract



Abstract

The purpose of this study was to evaluate Pb, Cr, and Cd levels inside the *Anadara granosa* and to investigate the effect of submersion using *Citrus aurantifolia* (Lime) and *Orthosiphon aristatus* (Kidney tea leaves) solution on Pb, Cr, and Cd levels contained in the blood cockles taken from 10 markets in the city of Semarang, Central Java, Indonesia (Johar, Genuk, Gayamsari, Jati, Peterongan, Karangayu, Mangkang, Pedurungan, Boom Lama, and Ngaliyan). The concentration of heavy metals of *Anadara granosa* was analyzed using Atomic Absorption Spectrometer (AAS). Analysis of variance (ANOVA) showed that heavy metals (Pb, Cd, and Cr) of blood cockle taken from 10 markets provided no significant difference ($P<0.05$) on the content of Pb, Cd and Cr. Purification was carried out using *Citrus aurantifolia* (lime) and *Orthosiphon aristatus* (kidney tea leaves) solution. The lowest Pb (0.00 mg $\cdot kg^{-1}$) was obtained from Boom Lama and Peterongan market with purification using kidney tea leaves solution, while the lowest Cr (0.30 ± 0.00 mg $\cdot kg^{-1}$) was obtained from Genuk market with lime solution. In addition, the lowest Cd (0.00 mg $\cdot kg^{-1}$) was obtained from Boom Lama market with purification using kidney tea leaves solution. Accumulation of heavy metal contamination in blood cockle could affect the micronutrient status and consumer health.

Keywords: *Anadara granosa*; heavy metals; micronutrients inhibitor; traditional market of Semarang City

1.0 INTRODUCTION

Heavy metals such as lead (Pb), chromium (Cr), and cadmium (Cd) are toxic contaminants that can cause biochemical changes and bioaccumulation in aquatic and its organisms. Not only adversely affect aquatic organisms, but also impact on humans who consume metal toxic of fish products. For example, heavy metals Pb are simply accumulated in the body of children [1]. The recent study pointed out that the accumulation of Pb is not only in the organs or in the blood, but also in the adipose fat tissue [2]. Pb and Cd poisoning in children can cause severe malnutrition due to micronutrients deficiency and impaired brain development [3].

Anadara granosa is a fishery product which is able to accumulate heavy metals. *Anadara granosa* is one type of blood cockle that has the potential and economic value to be developed as a source of protein and essential minerals to meet the nutrient adequacy in public health situation. *Anadara granosa* lives in a way to immerse in the mud, beneath the surface in shallow water [4]. The accumulation of Pb, Cr, and Cd in *Anadara granosa* through human consumption can be detrimental to health such as decreased renal function, memory loss, respiratory tract disorders, impaired liver function, and cancer [5–10].

The accumulation of Pb, Cr, and Cd inside *Anadara granosa* is caused by the nature, the location and the way to obtain the food as it is categorized as filter feeders that can accumulate metals from environment. In addition, due to differences in substrate where life and the life of older blood cockles also allow metals accumulate more than younger blood cockles [11]. A study in rats showed that *Citrus aurantifolia* (lime) reduced blood lead levels [12]. *Citrus aurantifolia* (lime) contains antioxidants

and some studies have confirmed such antioxidants could prevent metal toxicities [13, 14].

The purpose of this study was to evaluate Pb, Cr, and Cd levels inside the *Anadara granosa* and to investigate the effect of submersion using *Citrus aurantifolia* (lime) and *Orthosiphon aristatus* (kidney tea leaves) solution on Pb, Cr, and Cd levels of *Anadara granosa*.

2.0 EXPERIMENT

2.1 Materials

Materials used in this study were blood cockles of *Anadara granosa* taken from 10 traditional markets mentioned above. Blood cockles were collected for 1 kg each from every market with the size from 3 cm to 5 cm and weight of 10 g. Samples were taken using a plastic bag, a camera, a label, and a sterofoam box.

2.2 Research Methods

This study was conducted in two stages. The first stage was determined to asses the level of proximate, Pb, Cd, dan Cr in *Anadara granosa*. The second stage was to investigate the effect of *Citrus aurantifolia* (lime) and *Orthosiphon aristatus* (kidney tea leaves) solution on Pb, Cr, and Cd levels of *Anadara granosa*.

2.2.1 Sampling of the Blood cockles

About 500 g sample was taken directly from the traditional markets located in Semarang. The sample was then washed to remove dirt and then boiled to separate the blood cockles and blood cockle meat.

2.2.2 Sample Preparations

About 50 g sample was deluged inside 20 % solution of *Citrus aurantifolia* (lime) and *Orthosiphon aristatus* (kidney tea leaves) solution for 60 min. Concentration and time of submersion were determined using previous study with concentration of 10 %, 15 %, 20 %, 25 % and time of submersion of 30 min, 60 min and 90 min.

2.2.3 Testing of Heavy Metals by Atomic Absorption Spectrometer [15]

About 50 g sample was taken and then dried at a temperature of approximately 100 °C, then mashed into powder. The sample was dissolved into the vessel of 500 mg and added with nitric acid and perchloric acid in 1 mL and 2.5 mL of distilled water. Then it was put in a microwave digestion. Subsequently, the sample was analyzed using Atomic Absorption Spectroscopy (AAS). The working of this method was conducted by comparing the absorbance of the sample solution with the standard solution to obtain the concentration of the sample. Scale absorbance of AAS was calibrated with a standard series of known concentration. The result of the analysis of AAS was shown in a calibration curve. After measuring the absorbance the solution, the calibration curve was used to determine the concentration of sample solution. Factors that may affect the calibration process were AAS standard solution and AAS instrument.

2.2.4 Data Analysis

Heavy metal test results of *Anadara granosa* from 10 traditional markets in the city of Semarang, then, were analyzed by using analysis of variance or one–way ANOVA with IBM SPSS 22. This analysis was used to determine differences in the concentration of heavy metals such as Pb, Cd, and Cr in *Anadara granosa* taken from the 10 traditional markets in the city of Semarang.

3.0 RESULTS AND DISCUSSION

3.1 Proximate

Result of proximate analysis of *Anadara granosa* taken from 10 markets in Semarang city is shown in Table 1. It can be seen that the content of

moisture ranged from 66.61 ± 0.11 % to 72.25 ± 0.15 %, while protein was from 21.91 ± 0.08 % to 25.52 ± 0.33 %. In addition, the content of lipid ranged from 2.27 ± 0.22 % to 3.91 ± 0.07 %, while ash from 1.22 ± 0.13 % to 2.93 ± 0.07 %.

Table 1 Analysis of *Anadara granosa*'s proximate from 10 traditional markets in Semarang city

No	Samples code	Moisture (%)	Protein (%)	Lipid (%)	Ash (%)
1	Ps. Pedurungan	71.72 ± 0.05	21.91 ± 0.08	2.67 ± 0.08	2.32 ± 0.04
2	Ps. Genuk	71.28 ± 0.11	22.52 ± 0.11	3.12 ± 0.07	1.85 ± 0.11
3	Ps. Gayamsari	69.64 ± 0.19	23.40 ± 0.38	2.57 ± 0.05	2.86 ± 0.10
4	Ps. Johar	69.89 ± 0.02	22.85 ± 0.08	2.94 ± 0.02	2.82 ± 0.04
5	Ps. Jati	70.24 ± 0.02	22.62 ± 0.09	2.71 ± 0.13	2.89 ± 0.06
6	Ps. Peterongan	69.92 ± 0.05	22.95 ± 0.01	2.92 ± 0.10	2.91 ± 0.04
7	Ps. Boom Lama	72.25 ± 0.15	22.56 ± 0.47	2.27 ± 0.22	1.22 ± 0.13
8	Ps. Karangayu	68.82 ± 0.05	22.92 ± 0.10	3.91 ± 0.07	2.93 ± 0.07
9	Ps. Mangkang	70.83 ± 0.06	22.60 ± 0.05	2.94 ± 0.03	2.77 ± 0.26
10	Ps. Ngaliyan	66.61 ± 0.11	25.52 ± 0.33	3.50 ± 0.09	2.86 ± 0.07

Note: Average value of duplicate measurement ± standard deviaton.

A study of blood cockle taken from Teluk Tomini, Gorontalo, Indonesia obtained 65.69 % moisture, 23.23 % protein, 7.01 % lipid and 2.57 % ash [32]. This might be caused by the differences in enviromental condition, gender, age and fishing season.

3.2 Lead (Pb)

Lead (Pb) or black tin is a natural substance found in the earth's crust and often used in chemically manufactured industries (e.g. batteries industry, stationery industries, electrical wiring and coloring paint). Waste of lead (Pb) can often be found in the form of sediment, which can contaminate the waters and organisms such as blood cockle (*Anadara granosa*). Table 2 presents the results of lead (Pb) analysis of *Anadara granosa* at 10 traditional markets in Semarang city.

Table 2 Results of the analysis of *Anadara granosa's* lead (Pb) from 10 traditional markets in Semarang city

No.	Samples code	Lead (mg · kg^{-1})				
		I	II	III	Mean	SD
1	Ps. Pedurungan	0.24	0.23	0.23	0.23	0.01

2	Ps. Genuk	0.22	0.23	0.22	0.22	0.00
3	Ps. Gayamsari	0.20	0.20	0.20	0.20	0.00
4	Ps. Johar	0.18	0.18	0.18	0.18	0.00
5	Ps. Jati	0.17	0.18	0.17	0.17	0.00
6	Ps. Peterongan	0.14	0.15	0.15	0.15	0.00
7	Ps. Boom Lama	0.11	0.13	0.13	0.12	0.01
8	Ps. Karang ayu	0.12	0.12	0.11	0.12	0.00
9	Ps.Mangkang	0.10	0.10	0.10	0.10	0.00
10	Ps. Ngaliyan	0.09	0.09	0.09	0.09	0.00

Note: SD= Standard Deviation

Table 2 illustrates lead (Pb) contained in *Anadara granosa* taken from the traditional markets of Pedurungan, Genuk, and Gayamsari were the highest levels among the other traditional markets. Lead is a substance that is highly toxic or poisonous if absorbed into the body. Lead poisoning can be experienced by people of various ages especially in high–risk groups e.g. pregnant women. Exposing lead (Pb) during pregnancy could be a threat as it could flow through the placenta. For the fetus to be at risk of micronutrient deficiencies, malnutrition, to the chronically impaired brain development [3]. Lead poisoning is able to influence brain development by reducing the IQ, hyperactivity, hearing damage and impaired the child growth [16]. However, the content of lead (Pb) in the consumption of fishery products at generally northern coastal communities should remain a concern because of the nature of accumulation.

3.3 Chromium (Cr)

Chromium (Cr) is a metal that has been used extensively in human life such as industry, textiles, tanning, and explosives [17]. The chromium waste of industrial products generally is often discharged into waters which contaminate water and organisms such as blood cockle. Table 3 illustrates result analysis of chromium of *Anadara granosa* taken from 10 traditional markets in Semarang city.

Table 3 Results of *Anadara granosa*'s chromium (Cr) analysis from 10 traditional markets in Semarang city

No.	Samples code	Chromium (mg ·kg^{-1})				
		I	II	III	Mean	SD
1	Ps. Pedurungan	0.07	0.07	0.07	0.07	0.00
2	Ps. Genuk	0.08	0.08	0.08	0.08	0.00
3	Ps.Gayamsari	0.09	0.09	0.09	0.09	0.00
4	Ps. Johar	0.06	0.06	0.06	0.06	0.00
5	Ps. Jati	0.05	0.05	0.05	0.05	0.00
6	Ps. Peterongan	0.05	0.05	0.05	0.05	0.00
7	Ps. Boom Lama	0.04	0.04	0.04	0.04	0.00

8	Ps. Karangayu	0.06	0.06	0.06	0.06	0.00
9	Ps. Mangkang	0.06	0.06	0.06	0.06	0.00
10	Ps.Ngaliyan	0.04	0.04	0.04	0.04	0.00

Note: SD= Standard Deviation

Chromium (Cr) is an element that plays an important role in everyday life. At low concentrations in the form of Cr^{3+} (trivalent), chromium is an essential micronutrient for humans [18]. However, at high concentrations in the form of Cr^{6+} (hexavalent), it has been known to be carcinogenic [19]. Chromium in foods is mostly found in coral and sea water [18]. The sufficient quantity of chromium in the form of Cr^{3+} has been known to be able to improve the ability of insulin in the metabolism of glucose [20]. In addition, in the treatment of chromium parenteral nutrition, it has become one of the essential nutrients [18]. Nevertheless, the accumulation of the chromium in the tissue should not form Cr^{6+} as it is toxic and could be carcinogenic in the long–term exposure.

3.4 Cadmium (Cd)

Cadmium (Cd) is a toxic heavy metal elements often found in sewage pollution of waters and blood cockle other than lead (Pb) [21]. Result of analysis of cadmium (Cd) of *Anadara granosa* taken from 10 markets in Semarang city is shown in Table 4.

Anadara granosa, obtained from Genuk traditional market, contained the highest cadmium (0.16 ± 0.00 mg $\cdot kg^{-1}$), while the blood cockles from Ngaliyan market contained the lowest amount (0.06 ± 0.00 mg $\cdot kg^{-1}$). Cadmium will be transported by an enzyme transporter, which has trivalent in valency number and has a potential reduction into 2^{+}. It may then be accumulated in the kidneys and liver. If the concentration reaches 200 μg $\cdot g^{-1}$ or more, it will cause kidney damage. Cadmium metal source can be derived from the metals that may be plated with cadmium. Based on the WHO, cadmium consumption threshold is between 57 mg per d and 71 mg per d [22].

Table 4 Analysis of *Anadara granosa*'s cadmium (Cd) from 10 traditional markets in Semarang city

No	Samples code	Cadmium (mg $\cdot kg^{-1}$)				
		I	II	III	Mean	SD
1	Ps. Pedurungan	0.09	0.09	0.09	0.09	0.00
2	Ps. Genuk	0.16	0.16	0.16	0.16	0.00
3	Ps. Gayamsari	0.14	0.14	0.14	0.14	0.00
4	Ps. Johar	0.13	0.13	0.13	0.13	0.00
5	Ps. Jati	0.13	0.13	0.13	0.13	0.00
6	Ps. Peterongan	0.10	0.10	0.10	0.10	0.00
7	Ps. Boom Lama	0.09	0.09	0.09	0.09	0.00
8	Ps. Karangayu	0.08	0.08	0.08	0.08	0.00
9	Ps. Mangkang	0.09	0.09	0.09	0.09	0.00
10	Ps. Ngaliyan	0.06	0.06	0.06	0.06	0.00

Note: SD= Standard Deviation

In the biochemical process of human body, there are three main mechanisms of how the heavy metal interact and cause a variety of biochemical disturbances [23, 24]. The first mechanism is by entering the human body through food intake, through the digestive process, and is absorbed through the intestinal villi to the blood circulation. The second mechanism is after they enter the circulation, there is a trivalent metal receptor, which is unrecognized whether it is a metal that is essential or not essential to human body. The effect is there will be a complex competition between essential trace elements against non essential metal [25]. The third mechanism is in the long term effect, since imbalanced competition between non essential metal and essential trace elements, may cause essential micronutrients deficiency and functional disorders e.g. child growth and impaired brain development [26].

3.5 Lead, Cadmium, and Chromium Levels after Purification using *Citrus aurantifolia* (lime) and *Orthosiphon aristatus* (kidney tea leaves) Solution

3.5.1 Lead (Pb)

Figure 1 and figure 2 depict the decrease of lead in Anadara granosa after purification with *Citrus aurantifolia* (lime) and *Orthosiphon aristatus* (kidney tea leaves) solution. Submersion using *Orthosiphon aristatus* showed significant reduction of lead concentration compared to *Citrus aurantifolia* solution.

After purification of *Anadara granosa* with *Orthosiphon aristatus* solution, the highest amount of lead (0.57 ± 0.08 mg · kg^{-1}) was obtained by those from Jati market, while the blood cockles obtained from Boom Lama and Peterongan market contained the lowest amount of lead (0.00 mg · kg^{-1}). Purification of *Anadara granosa* from Gayamsari traditional market using *Citrus aurantifolia* solution resulted in the highest content of lead (1.82 ± 0.00 mg · kg^{-1}), whereas the blood cockles obtained from Mangkang traditional market contained the lowest lead (1.57 ± 0.00 mg · kg^{-1}). In addition, *Anadara granosa* taken from the market of Muara Angke provided lead that exceeded the threshold (3.5 ppm to 6.21 ppm) [29]. The permissible levels of Pb set by the Commission Regulation of EU (2006) for human consumption was 1.00 µg · g^{-1} or 1.00 ppm [28].

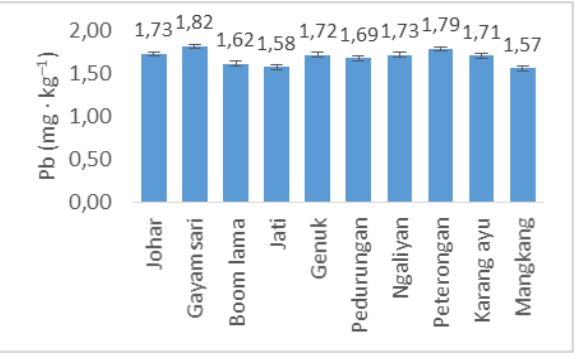


Figure 1 *Anadara granosa*'s lead (Pb) from 10 traditional markets in Semarang City after purification using *Citrus aurantifolia*

A study about *Avicennia marina* showed that 25 % *Citrus aurantifolia* solution reduced the level of lead from 1.78 ppm to 0.71 ppm [27]. In addition, the other study of boiled beef liver using 10 % kidney tea leaves solution resulted in the reduction of lead from 0.069 ppm to 0.017 ppm [33]. The decrease in the content of lead might be caused by the denaturation of protein of blood cockles with regard to acid treatment. This could cause the release of metal complex bonds of the meat along with body fluids [30].

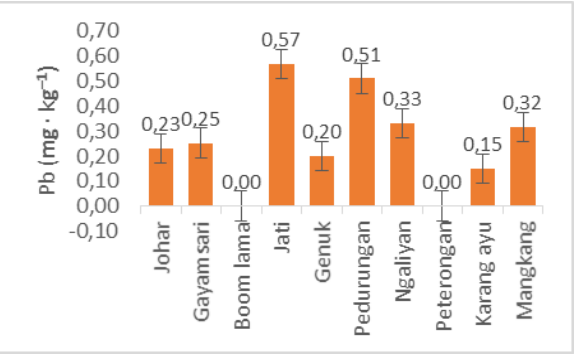


Figure 2 *Anadara granosa's* lead (Pb) from 10 traditional markets in Semarang City after purification using *Orthosiphon aristatus*

3.5.2 Chromium (Cr)

The submersion of *Anadara granosa* using *Citrus aurantifolia* significantly decreased the chromium level compared to that using *Orthosiphon aristatus*. The purification of *Anadara granosa* obtained from Jati traditional market using *Orthosiphon aristatus* solution resulted in the highest level of chromium (6.26 ± 0.03 mg · kg^{-1}), while those obtained from Peterongan traditional market provided the lowest chromium (3.87 ± 0.03 mg · kg^{-1}).

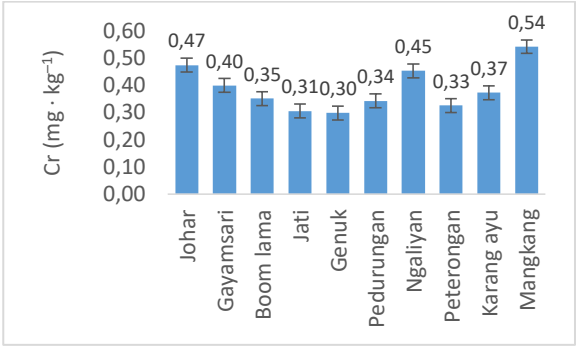


Figure 3 *Anadara granosa's* chromium (Cr) from 10 traditional markets in Semarang city after purification using *Citrus aurantifolia*

In addition, the purification of *Anadara granosa* obtained from Mangkang traditional market using *Citrus aurantifolia* solution presented the highest chromium (0.54 ± 0.00 mg · kg–1), whereas the blood cockles obtained from Genuk traditional market showed the lowest level of chromium (0.3 ± 0.00 mg · kg–1). Meanwhile, *Anadara granosa* taken from Muara Sayung river was found to contain chromium between 0.13 ppm to 0.16 ppm [31]. A study about boiled beef liver revealed that 10 % kidney tea leaves solution could reduce chromium from 0.732 ppm to undetected value [33].

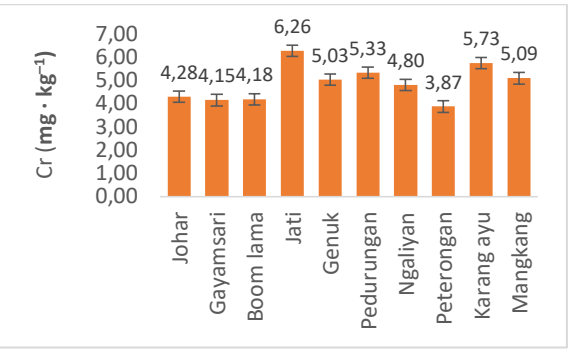


Figure 4 *Anadara granosa's* chromium (Cr) from 10 traditional markets in Semarang City after purification using *Orthosiphon aristatus*

3.5.3 Cadmium (Cd)

Figure 5 and figure 6 show that *Orthosiphon aristatus* solution significantly reduced cadmium (Cd) levels of *Anadara granosa* compared to *Citrus aurantifolia* solution. After purification of *Anadara granosa* from Jati traditional market with *Orthosiphon aristatus* solution, the highest level of cadmium (0.47 ± 0.02 mg · kg^{-1}) was obtained, while the blood cockles from Boom Lama traditional market showed the lowest cadmium level (0.00 mg · kg^{-1}).

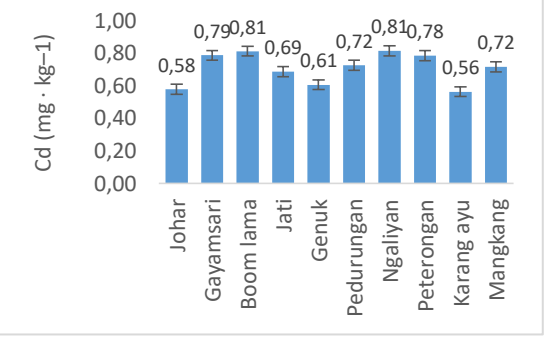


Figure 5 *Anadara granosa's* cadmium (Cd) from 10 traditional markets in Semarang city after purification using *Citrus aurantifolia*

In addition, the purification of *Anadara granosa* obtained from Ngaliyan traditional market with *Citrus aurantifolia* solution resulted in the highest cadmium level (0.81 ± 0.00 mg · kg^{-1}), while the blood cockles obtained from Genuk traditional market provided the lowest level (0.6 ± 0.00 mg · kg^{-1}). These results met the maximum standards of cadmium content in bivalvia regulated by Badan Standarisasi Nasional (2009), which is 1.00 mg · kg^{-1} [34]. *Anadara granosa* taken from the market of Muara Angke was found to contain cadmium between 0.25 ppm and 0.83 ppm [29]. According to a study about boiled beef liver [33], the use of 10 % kidney tea leaves solution reduced cadmium level from 1.283 ppm to undetected level.

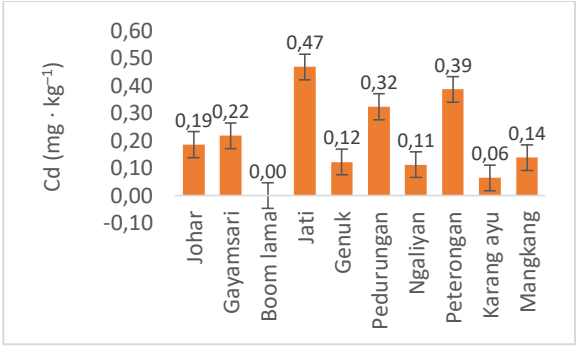


Figure 6 *Anadara granosa*'s Cadmium (Cd) from 10 traditional markets in Semarang city after purification using *Orthosiphon aristatus*

4.0 CONCLUSION

High level of lead (Pb), chromium (Cr), and cadmium (Cd) were found in *Anadara granosa* taken from 10 traditional markets in the city of Semarang. Based on the criteria of food quality and considering of the characteristics of heavy metals that can accumulate in the human body, it could be emphasized that *Anadara granosa* is unfavorable for consumption in the long–term. This study recommends dissolution using *Citrus aurantifolia* (lime) and *Orthosiphon aristatus* (kidney tea leaves) solution that could be applied on food processing for reducing the level of Pb, Cd, and Cr of *Anadara granosa*.

Acknowledgement

This study is partly a research grant funded by PNBP of Fisheries and Marine Sciences Faculty, Diponegoro State University. On this opportunity, the authors would like to thank Ministry of Research, Technology and Higher Education for this funding. The authors would also like to thank the students: Astutik L. S. and Tito R. N. S. who have helped in completing this research.

References

[1] WHO. 2014. Exposure to Lead: A Major Public Health Concern. Preventing Disease through Healthy Environtments. [Online]. From: http://www.who.int/ipcs/features/lead.pdf. [Accessed on 4 July 2015].

[2] Vallascas, E., A. De Micco, F. Deiana, S. Banni and E. Sanna. 2013. Adipose Tissue: Another Target Organ for Lead Accumulation? A Study on Sardinian Children (Italy). *Am. J. Hum. Biol*. 25: 789–794.

[3] Wasserman, G. A., X. Liu, P. Factor–Litvak, J. M. Gardner and J. H. Graziano. 2008. Developmental Impacts of Heavy Metals and Undernutrition. *Basic & Clinical Pharmacology & Toxicology*. 102: 212–217.

[4] Haslaniza, H., M. Y. Maskat, W. Aida and S. Mamot. 2014. Process Development for the Production of Protein Hydrolysate from Cockle (*Anadara granosa*) Meat Wash Water. *Sains Malaysiana*. 43(1): 53–63.

[5] Fischer, A. B., R. Georgieva, V. Nikolova, J. Halkova, A. Bainova, V. Hristeva, *et al*. 2003. Health Risk for Children from Lead and Cadmium Near a Non-Ferrous Smelter in Bulgaria. *Int. J. Hyg. Environ. Health*. 206: 25–38.

[6] Kavcar, P., A. Sofuoglu and S. C. Sofuoglu. 2009. A Health Risk Assessment for Exposure to Trace Metas Via Drinking Water Ingestion Pathway. *Int. J. Hyg. Environ. Health*. 212: 216–227.

[7] Khan, S., S. Rehman, A. Z. Khan, A. Khan and M. T. Shah. 2010. Soil and Vegetables Enrichment with Heavy Metals from Geological Sources in Gilgit, Northern Pakistan. *Ecotoxicol. Environ Saf*. 73: 1820–1827.

[8] Mijal, R. S. and C. B. Holzman. 2010. Blood Cadmium Levels in Women of Child Bearing Age Vary by Race/Ethnicity. *Environ. Res*. 110: 505–512.

[9] Zhao, H., B. Xia, C. Fan, P. Zhao and S. Shen. 2012. Human Health Risk from Soil Heavy Metal Contamination under Different Land Uses Near Dabaoshan Mine, Southern China. *Sci. Total Environ*. 417–418: 45–54.

[10] Er, C., B. F. Senkal and M. Yaman. 2013. Determination of Lead in Milk and Yoghurt Samples by Solid Phase Extraction Using a Novel Aminothioazole–Polymeric *Resin. Food Chem*. 137(1–4): 55–61.

[11] Rainbow, P. S. 2006. Biomonitoring of Trace Metals in Estuarine and Marine Environments. *Aust J Ecotoxicol*. 12: 107–122.

[12] Aprioku, J. S. and A. W. Obianime. 2014. Evaluation of the Effects of *Citrus aurantifolia* (Lime) Juice on Lead-Induced Hematological and Testicular Toxicity in Rats. *Pharmacologia.* 5: 36–41.

[13] Shrestha, R. L., D. D. Dhakal, D. M. Gautum, K. P. Paudyal and S. Shrestha, 2012. Variation of Physiochemical Components of Acid Lime (*Citrus aurantifolia* swingle) Fruits at Different Sides of the Tree in Nepal. *Am. J. Plant Sci.* 3: 1688–1692

[14] Ayinde, O. C., S. Ogunnowo and R. A. Ogedegbe. 2012. Influence of Vitamin C and Vitamin E on Testicular Zinc Content and Testicular Toxicity in Lead Exposed Albino Rats. *BMC Pharmacol. Toxicol*. 13(17): 1–8.

[15] Association of Official Analytical Chemists (AOAC). 1996. *Official Methods of Analysis. 16th Edn.* Washington DC: AOAC Inc.

[16] Meyer, P. A., M. A. Mc. Geehin and H. Falk. 2003. A Global Approach to Childhood Lead Poisoning Prevention. *International Journal Hygiene Environmental Health*. 206: 363–369.

[17] Miller-Ihli, N. J. 1992. Chromium, USDA, Nutrient Composition Laboratory. In: Stoepler, M. (Ed). *Hazardous Metals in the Environment*. Germany: Institud Fur Chemie.

[18] Cefalu, W. T. and F. B. Hu. 2004. Role of Chromium in Human Health and in Diabetes. *Diabetes Care*. 27(11): 2741–2751.

[19] Holmes, A. L., S. S. Wise and J. P. Wise Sr. 2008. Carcinogenicity of Hexavalent Chromium. *Indian Journal of Medical Research*. 128(4): 353–372.

[20] Jeejeebhoy, K. N., R. C. Chu, E. B. Marliss, G. R. Greenberg and A. Bruce-Robertson. 1977. Chromium Deficiency, Glucose Intolerance, and Neuropathy Reversed by Chromium Supplementation, in a Patient Receiving Long–Term Total Parental Nutrition. *Am J Clin Nutr*. 30: 531–538.

[21] Kwok, C. K., Y. Liang, H. Wang, Y. H. Dong, S. Y. Leung and M. H. Wong. 2014. Bioaccumulation of Heavy Metals in Fish and Ardeid at Pearl River Estuary, China. *Ecotoxicology and Environmental Safety*. 106: 62–67.

[22] Needleman, H. L. 2004. Low Level Lead Exposure and the Development of Children. *Southeast Asian Journal of Tropical Medicine and Public Health*. 35: 252–254.

[23] Kordas, K., B. Lönnerdal and R. J. Stoltzfus. 2007. Interactions between Nutrition and Environmental Exposures: Effects on Health Outcomes in Women and Children. *The Journal of Nutrition*. 137(12): 2794–2797.

[24] Kippler, M., B. Lönnerdal, W. Goessler, E. C. Ekström, S. El Arifeen and M. Vahter. 2009. Cadmium Interacts with the Transport of Essential Micronutrients in the Mammary Gland – A Study in Rural Bangladeshi Women. *Toxicology*. 257(1): 64–69.

[25] Kim, Y. and S. Park. 2014. Iron Deficiency Increases Blood Concentrations of Neurotoxic Metals in Children. *Korean Journal of Pediatrics*. 57(8): 345–350.

[26] Dorea, J. G., R. C. Marques and C. Isejima. 2012. Neurodevelopment of Amazonian Infants: Antenatal and Postnatal Exposure to Methyl-and Ethylmercury. *Journal of Biomedicine and Biotechnology*. 2012: 1–9.

[27] Sulistiyati, T. D., S. Setyoyuwono, E. Y. Herawati and Sumarno. 2013. Reduction of Lead (Pb) with Na_2 EDTA, Lime and Vinegar Acid in Fruit Processing Wheat Avicennia Marina. *Journal of Food Studies*. 2(1) : 93–99.

[28] Azelee, I. W., R. Ismail, R. Ali and W.A. Bakar. 2014. Chelation Technique for the Removal of Heavy Metals (As, Pb, Cd, and Ni) from Green Mussel, *Perna viridis*. *Indian Journal of Geo-Marine Sciences.* 43(3): 372–376.

[29] Nurjannah, Hartati and R. R. Nitibaskara. 1999. Analisa Kandungan Logam Berat Hg, Cd, Pb, As dan Cu dalam Tubuh Kerang Konsumsi (Analysis of Heavy Metal Content Hg, Cd, Pb, As and Cu In Body Blood cockles Consumption). *Buletin THP*. 1(6): 5–8. [Bahasa Indonesia].

[30] Winarno, F. G. 1992. *Kimia Pangan dan Gizi (Chemistry and Nutrision of Food)*. Jakarta: Gramedia Pustaka Utama. [Bahasa Indonesia].

[31] Suprapti, N. H. 2008. Kandungan Chromium pada Perairan, Sedimen dan Kerang Darah (*Anadara granosa*) di Wilayah Pantai Sekitar Muara Sungai Sayung, Desa Morosari Kabupaten Demak, Jawa Tengah [Content of Chromium in Water, Sediment and Bood Cockle (*Anadara granosa*) around Muara Sayung River, Morosari Demak, Central Java]. *Journal Bioma*. 10(2): 53–56. [Bahasa Indonesia]

[32] Nurjannah, Zulhamsyah and Kustiyariyah. 2005. Kandungan Mineral dan Proksimat Kerang Darah (*Anadara Granosa*) yang Diambil dari Kabupaten Boalemo, Gorontalo [Mineral and Proximate Content of Blood Cockle (*Anadara granosa*) Taken from Boalemo, Gorontalo]. *Buletin THP*. 8(2): 15–24. [Bahasa Indonesia].

[33] Dwiloka, B., D. L. M. R. Rasana'e and E. Rianto. 2006. Kandungan Logam Berat pada Hati dan Usus Sapi yang Dipelihara di TPA Jatibarang Semarang Setelah Direbus dengan Daun Kumis Kucing (*Orthosiphon stamineus Benth*) [Heavy Metal in Liver and Colon of Cows Rised at TPA jatibarang Semarang Cooked with *Orthosiphon stamineus Benth*)]. *Risalah Seminar Ilmiah Aplikasi Isotop dan Radiasi*. 1(2): 33–41. [Bahasa Indonesia].

[34] Badan Standarisasi Nasional. 2009. Batas Maksimum Cemaran Logam Berat dalam Pangan SNI 7387:2009 [The Maximum Limit of Heavy Metal in Food SNI 7387:2009]. Jakarta: Badan Standarisasi Nasional. [Bahasa Indonesia].

Re: Final check naskah Bu Thea (heavy metal)

Dari: Rosita Dwi Chandra,S.TP, M.FoodSt(Adv) (rosita.dwi@machung.ac.id)
Kepada: roy_hendroko@hotmail.com; fronthea_thp@undip.ac.id; fronthea_thp@yahoo.co.id; fronthea_thp@yahoo.com
Cc: monika.nur@machung.ac.id
Tanggal: Senin, 22 Februari 2016 21.49 WIB

Yth. Bu Thea,

Ibu bisa mendownload naskah Ibu di email ini apabila Ibu ingin mengecek kembali naskah tersebut.

Terima kasih.

Salam,

Rosita

From: Rosita Dwi Chandra,S.TP, M.FoodSt(Adv)
Sent: Monday, February 22, 2016 9:40 PM
To: roy hendroko; fronthea_thp@undip.ac.id; Undip yahoo.co.id Thea; Dr fronthea Swastawati
Cc: Monika Nur Utami Prihastyanti, S.TP, M.Nat.Sc
Subject: Final check naskah Bu Thea (heavy metal)

Yth. Pak Roy,

Berikut saya kirimkan naskah Bu Thea untuk diproses final check. Mohon berkenan untuk mengecek naskah tersebut.

Terima kasih.

Salam,

Rosita

Update status naskah JT UTM

Dari: Monika Nur Utami Prihastyanti, S.TP, M.Nat.Sc (monika.nur@machung.ac.id)

Kepada: fronthea_thp@yahoo.co.id; fronthea_thp@undip.ac.id; roy_hendroko@hotmail.com; ekothp@live.undip.ac.id; katarina.purnomo@machung.ac.id; rosita.dwi@machung.ac.id; 331410017@student.machung.ac.id

Tanggal: Jumat, 26 Februari 2016 11.37 WIB

yth. Rekan-rekan sekalian,

Melalui email ini, saya lampirkan database naskah JT UTM. Total naskah yang sudah masuk final check adalah 40 naskah, detail status naskah ada pada lampiran yang saya kirimkan.

Hari ini kami akan selesaikan kelengkapan dokumen lain (seperti review form dan CTA) supaya siap kirim ke JT UTM.

Demikian yang dapat saya sampaikan. Mohon doanya supaya prosesnya berjalan dengan lancar.

Terima kasih

Salam,

Monika

Status Naskah JT-UTM (2016.02.26, 11.00 am).xlsx
68.3kB

JT-UTM Vol. 78 No4-2

Dari: roy hendroko (roy_hendroko@hotmail.com)

Kepada: fronthea_thp@yahoo.co.id; laras_rianingsih@yahoo.com; lukita_anandito@yahoo.com; ekothp@live.undip.ac.id

Cc: praptiningsih.ga@gmail.com; monika.nur@machung.ac.id; katarinapurnomo@gmail.com; rosita.dwi@machung.ac.id

Tanggal: Senin, 18 April 2016 10.24 WIB

Ysh Para Rekan.
Mohon doa agar proef Vol 78 No 4-2 yang saya unggah dapat segera on-line. Insya Allah dapat memenuhi deadline Rektor UNDIP, yakni sebelum 21 April 2016.
Maturwun.

Wass
RHS

Vol 78, No 4-2_ Sustaining Fish Processing Industry to Support Global Maritime Axis.pdf
307.7kB

Fw: Notification of Publication Jurnal Teknologi (Sciences & Eng.) Special Issue: Sustaining Fish Processing Industry to Support Global Maritime Axis

Dari: roy hendroko (roy_hendroko@hotmail.com)

Kepada: fronthea_thp@yahoo.co.id; laras_rianingsih@yahoo.com; lukita_anandito@yahoo.com; ekothp@live.undip.ac.id

Cc: monika.nur@machung.ac.id; katarinapurnomo@gmail.com; rosita.dwi@machung.ac.id; tatas.brotosudarmo@machung.ac.id; chatief.kunjaya@machung.ac.id

Tanggal: Senin, 18 April 2016 12.50 WIB

Ysh Ibu Dr. Fronthea Swastawati
UNDIP

Dengan ucapan Alhamdulillah, saya dengan gembira dan bangga melaporkan hasil kerja kita telah on-line di Jurnal-Tehnologi Vol. 78 No 4-2, seperti forward email di bawah ini, dan juga atach email. Puji syukur pula kami (saya + Bu Prapti dan Tim MRCPP) mampu menyelesaikan sebelum deadline tanggal Rektor UNDIP. Hari ini tanggal 18 April 2016, sedang tengat waktu adalah Hari Kartini, 21 April 2016.
Puji syukur, kita dapat mengatasi sejumlah "kendala birokrasi" di Malaysia. Seperti diketahui semula kita diberi jatah Vol. 78 No 3. Tetapi dengan alasan manuskrip ISAPPROSH membutuhkan sejumlah revisi maka Vol jatah kita "diberikan/ dipindahkan" ke conference/ issue yang lain. Namun berkat bantuan dan kerja keras Mbak Laras + Mbak Lukita yang membantu "mengejar" revisi 20 author, kita mampu menyelesaikan revisi maju dibanding skedul.
Demikian pula di revisi ke-2 terhadap 10 author, Mbak Monika, Mbak Rosita (bahkan Mbak Katrin di jelang pemberkatan pernikahannya) penuh semangat menyelesaikan revisi lebih maju dari skedul yang ditetapkan oleh editor JT-UTM.
Seperti Anda melihat di sini (http://www.jurnalteknologi.utm.my/index.php/jurnalteknologi/issue/archive) sampai hari ini (18 April 2016) ternyata Vol 78 No 2, Vol. 78 No 3 dan Vol 78 No. 4 yang mereka mencadangkan untuk sejumlah conference/ issue tersebut TIDAK/ Belum mampu submit untuk online.
Maturwun atas segala kerjasama yang baik sehingga JT-UTM dapat terselesaikan. Namun kita masih mempunyai PR tentang manuskrip ISAPPROSH yang lain.

Allah memberkati karya kita.
Roy Hendroko Setyobudi

From: HAPIZAH BINTI MOHMAD@MOHAMAD TNCPI <piza@utm.my>
Sent: Monday, April 18, 2016 10:54 AM
To: roy hendroko
Cc: ROSLI BIN MD. ILLIAS TNCPI; KASSIM BIN THUKIMAN TNCPI; UNGKU HALIZA BT UNGKU ZAHAR TNCPI; MD RAZIB BIN KARNO PSZ
Subject: Notification of Publication Jurnal Teknologi (Sciences & Eng.) Special Issue: Sustaining Fish Processing Industry to Support Global Maritime Axis

Dear Professor,

The Special Issue on Sustaining Fish Processing Industry to Support Global Maritime Axis **has been successfully uploaded. Kindly visit the following links:**

http://www.jurnalteknologi.utm.my/index.php/jurnalteknologi/issue/view/256

The inter-frame is attached. Any inquiries/corrections kindly let me know within two weeks time.

Please note that any request of adding or changing of authors/affiliations/contents will not be

entertained except those mistakes occurred because of our negligence.

Thank you

Hapizah Mohamad
Publication Officer (Journal)

Penerbit UTM Press
Universiti Teknologi Malaysia
81310 UTM Johor Bahru
Johor, Malaysia

Office:07-5535684 | Mobile: -
Primary Email: piza@utm.my | Secondry Email: pizamohd@gmail.com| Site: www.penerbit.utm.my


Vol 78, No 4-2.pdf
214.9kB