



# PROCEEDING

## CSSH+

International Conference  
on Sport Sciences and Health

Preparing Young People in  
Global Economic Challenges in Sport and Health  
Malang, September 23, 2017

Sport Sciences Faculty  
State University of Malang



978-602-71646-2-8

# **The 1<sup>st</sup> International Conference on Sports Science and Health**

## **THE PROCEEDINGS BOARD OF EDITORIAL**

### **ADVISOR**

Prof. Dr. M.E Winarno, M.Pd

**ISBN : 978-602-71646-2-8**

### **EDITOR**

1. Dr. Asim, M.Pd
2. Dr. Hariyoko, M.Pd
3. Dr. Mahmud Yunus, M.Kes
4. Dr. Slamet Rahardjo, M.Or
5. Drs. Supriatna, M.Pd
6. Nurrul Riyad Fadhli, S.Pd., M.Or
7. Dona Sandy Yudasmaras, S.Pd., M.Or

### **REVIEWER**

1. Prof. Mohd. Salleh Aman, Ph.D
2. Dee dee Mahmoud, Ph.D
3. Drs. Suroto, M.A., Ph.D
4. Dr. Mathew Lantz Blaylock, Ph.D

### **COVER DESIGNER**

Aditya Yudha

### **PUBLISHER**

Fakultas Ilmu Keolahrgaan, Universitas Negeri Malang  
Jalan Semarang 5 Malang  
Email: [icssh.fik@um.ac.id](mailto:icssh.fik@um.ac.id)

### **DISTRIBUTOR**

Fakultas Ilmu Keolahrgaan, Universitas Negeri Malang  
Jalan Semarang 5 Malang  
Email: [icssh.fik@um.ac.id](mailto:icssh.fik@um.ac.id)

First Edition, September 2017

Copyrights is protected by the law

All rights reserved. Except for use in a review, the reproduction or utilization of this work in any form or by any electronic, mechanical, or other means, now known or hereafter invented, including xerography, photocopying, and recording, and in any information storage and retrieval system, is forbidden without the written permission of the publisher.

## PREFACE

*Assalamualaikum Warrahmatullahi Wabarakatuh*

The honorable speakers, Prof. Saleh Aman (Malaysia), Feeder Mahmood (Singapore), Matthew Lantz Blaylock (US) and Suroto,. (Indonesia).

First of all, on behalf of the committee of the International Conference Sport Science and Health let me express great thanks to God Allah SWT who gives us opportunity and health, so that we can join this International Conference Sport Science and Health. It is my pleasure to welcome you to the International Conference Sport Science and Health in Faculty of Sport Science Malang State University. The international conference is in order to celebrate the 63th anniversary of Malang State University. In this opportunity, we invite four speakers from four countries; they are from Malaysia, Singapore, Alabama, and Indonesia. The participants of the conference are 250 participants. The presenters of the conference are 35 presenters.

Finally, allow me to express my gratitude to all audiences, especially the honorable speakers and the distinguished guests for paying attention to this seminar. I hope that the conference will run well and be successful. Thank you very much.

*Wassalamualaikum Warrahmatullahi Wabarakatuh*

## Welcoming Speech of Rector Universitas Negeri Malang

Malang, 23 September 2017

Dear ICSSH 2017 participants,

Welcome to the first International Conference on Sport Sciences and Health 2017 (ICSSH 2017).

The Faculty of Sport Sciences in Universitas Negeri Malang is our second youngest faculty which has just been established in 2008. At the moment the Faculty of Sport Sciences has five Departments; Physical Education and Health Sciences, Sports Science, Sport Coaching Education and Public Health and Postgraduate Program of Sports Education.

The International Conference on Sport Sciences and Health is a milestone for the Faculty of Sport Sciences to open the possibility of collaborating to practitioners around the world, building amazing networking aiming to develop the sports and health education in Indonesia.

I warmly welcome the conference participants to Malang, Indonesia. This conference invites you all to extensively and intensively explore and discuss various aspects of how young people facing the global economic challenges.

Indonesia actively and dynamically learns how to engage its people to perform daily exercise and conducting healthy life style, thus, we love to explore any possibilities by learning from the diverse experiences of other countries. Indonesia also enthusiastically joins the world on empowering young people to be the motor of country's economic development. The conference sums it up on this year's theme of "Preparing Young People in Global Economic Challenges in Sport and Health".

Universitas Negeri Malang is committed to supporting the forum to share ideas, insights, and interesting strategies to nurture the sport and health culture for all people. Hence, we are delighted to see many academics, researchers and practitioners, teachers and students to actively participate in this conference. Please do take as much benefit as you can from this conference and enjoy Universitas Negeri Malang.

Regards,

Dr. Syamsul Hadi, M.Si., M.Ed  
Vice Rector  
Universitas Negeri Malang

## TABLE OF CONTENTS

Cover		i
Editorial Boards		ii
Preface		iii
Welcoming Speech From Rector Universitas Negeri Malang		iv
Table of Contents		v
“Sport management careers and the need of general skill for young people in entering the new global economy” By: Prof. Mohd. Salleh Aman, Ph.D		1
“Empowerment of Youths in the Globalisation of Careers in Health and Fitness” By: Dee Dee Mahmoud., PhD		6
“Measuring Competency Of Prospective PE Teachers And PE Teachers In Digital Era: Based On National Standard For Indonesian” By: Drs. Suroto., M.A., Ph.D		10
1. The Influence Of Passing-Moving Training Dan Command Style Training Towards The Vo2 Max Improvement Of Futsal Player	Ayik Syaikhul, Hariyoko	24-33
2. Evaluation Of Lesson Plan (RPP) On Semester I Physical And Health Education In SMPN 6 Malang	Veni Imawati, M E Winarno, Gema Fitriyadi	34-47
3. Development Of Basketball Variation Of Basketball Dribbling Practices For Extracurricular Participants	Choirul Mala A, Siti Nurrochmah, Febrita Paulina H	48-63
4. Improving Volleyball Forearm Pass Basic Skills Using Various Drills Method	Eva Novitasari, Agus Tomi, Dona Sandy	64-69
5. Effect Of Exercise Regularly And Non Regularly In Calcium Content Of Bone	Harris Catur W, Rias Gesang K, Slamet R	70-74
6. The Effect Of Rhythmic Body Movement On The Balance Of The Body Of Mentally Disabled Children	Rensy Dwi A, Saichudin, Slamet R	75-83
7. The Effect Of Regulating And Not Regulated Exercises To The Blood SOD Activity	Muchammad Rif’at Fawaid A, Rias Gesang K, Olivia A.	84-91
8. Level Of Coaches’ Understanding On Exercise Program In Koni Malang	Imam Hariadi, Nurrul Riyad Fadhli,	92-96
9. The Influence Of Model Combination Exercise: Passing, Dribble, And Shooting In Improving Basketball Skills For Senior High School Students	Septianto Andika Putra	97-104
10. The Effect Of Dribble Variations Exercise Based On Playing Situation On Dribbling Skill Of Youth Athletes	Moch. Yunus, Shan Willies	105-111
11. Takraw Low Service Training Model For Junior Athletes	Romadhoni, Supriatna, Muchamad Dwi Hanavi, Roesdiyanto,	112-116
12. Effect Of Plyometrics Exercise On Increasing Leg Muscle Power Of Female Volleyball Athlete	Firman Nur Ardyan Syah,	117-124

13	The Effect Of The Exercisevariations Of Forearm Pass On The Improvement Of Forearm Pass Basic Skill In Volleyball	Setyo Budiwanto, Emania Agestin, Sulistyorini,	125-133
14	Relationship Of Body Mass Index (BMI), Waist Circumference, And Total Cholesterol With Incidence Of Hypertension	Betrix Rifana Kusumaning Indah, Endang Sri Redjeki, Rara Warih Gayatri,	134-141
15	The Effect Of Knowledge And Family Socioeconomic To The Implementation Of Clean And Healthy Living Behavior Towards Household Level In Working Area	Dwi Wahyu Yuliandari, Nurnaningsih Herya Ulfah, Endah Retnani Wismaningsih,	142-147
16	Building Adaptive Physical Education With A Neuropathophysiology Approach In The New Paradigm Of Physical Education	Mochammad Bhirowo	148-160
17	The Effect Of Shadow Shuttlecock, Trainer Direct Command And Free Shadow Footwork On Badminton Agility	Adi Wijayanto, Hari Setijono, Occe Wiriawan,	161-171
18	Analysis Of Electromyogram On Takraw Basic Techniques	Rusli, Hari Setijono, Edy Mintarto,	172-181
19.	The Role Of Blended Learning For Student Learning Character In Physical Education	Mazhar Bagus Setyawan	182-188
20.	Economic Empowerment For Former Leprosy Patient Through Cultivation Of Mosquito Repellent Plants	Puri Ratna Kartini, Ani Sulistyarsi, Arum Suproborini	189-195
21.	Sports Education And Science School Technology Progress	Mat Wajib	196-201
22.	The Content Of Metal Elements In Medicinal Plants In Dusun Mesu Desa Boto Jatiroto Wonogiri Central Java Indonesia	Arum Suproborini, M.S.Djoko Laksana, Dwi Fitri Yudiantoro	202-208
23.	Nutritional Status Of Indonesian Martial Arts Athlete	Moh.Nur Kholis, Setyo Harmono	209-213
24.	The Development Of Edutainment Anatomy Learning Material Based On Android For College Students	Farizha Irmawati Erfitra Rezqi Prasmala Ika Oktavia Purnamasari	214-218
25.	Evaluation Of Tennis Resource Management	Isnaini Dina Rahmawati Agus Kristiyanto, Kiyatno	219-225
26.	Strengthen The Indonesian Economic Society Through Sport Tourism	Titin Kuntum Mandalawati	226-231

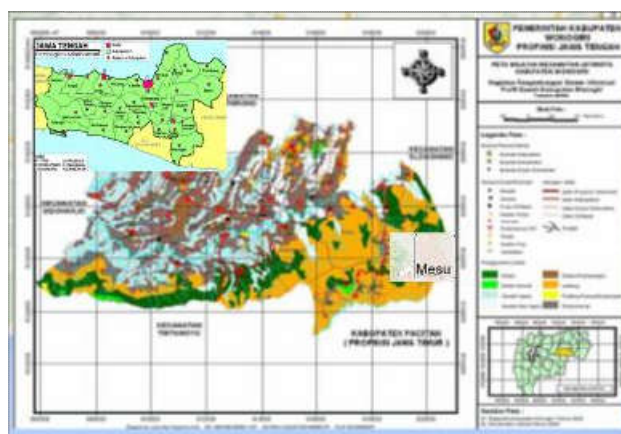
## THE CONTENT OF METAL ELEMENTS IN MEDICINAL PLANTS IN DUSUN MESU DESA BOTO JATIROTO WONOGIRI CENTRAL JAVA INDONESIA

**Arum Suproborini**, Universitas PGRI Madiun  
**M.S.Djoko Laksana**, UPN Veteran Yogyakarta  
**Dwi Fitri Yudiantoro**, UPN Veteran Yogyakarta  
Email: arum.suproborini15@gmail.com

**Abstract:** This study aims to determine the content of elements of As, Hg, Mn, and vegetation analysis of medicinal plants. The research method used is survey method. Crop sampling using purposive random sampling method. Crop samples analyzed the content of As, Hg, and Mn by XRF method. The analysis was conducted on 6 types of medicinal plants. The results of XRF analysis showed that soil and plant samples contain high As, Hg, and Mn elements.

**Keywords:** medicinal plants, metal elements, vegetation analysis

The research area is morphologically included in the form of volcanic hill land with an average slope of 30 °, temperatures ranging from 24-32 ° C with an average rainfall of 1.845 mm / year



**Figure 1. Map of Research Locations**

Abissalam, et al. (2009), explains that based on an integrated study that includes geomorphology, stratigraphy, geological structure, petrology, alteration, and mineralization shows that this region is a fossil of ancient volcanoes. This ancient volcano was formed on the ocean floor and is part of the volcano archipelago arches. The interaction between magma, hydrothermal fluid and surrounding rocks leads to alteration and mineralization in facies of the volcano center. The mineralization process produces metal elements such as Fe, Mn, Cu, Pb, Hg, As, Zn, Ag, and other metal elements (Putranto, 2011). The content of metal elements in nature can affect the existing vegetation. Vegetation is defined as the whole plant of an area consisting of herbs, shrubs, trees that live together somewhere, interacting with each other and with their environment

(Agustina, 2008; Maryantika et al., 2010, Susanto, 2012). One type of vegetation planting plant is a medicinal plant. The definition of medicinal plants in botanical is a plant that can be used as medicine (roots, stems, leaves, flowers). Utilization of medicinal plants can be boiled by drinking water or extracted. The existence of medicinal plants is very important for the local community.

Heavy metal is a high molecular weight metal element. In low levels heavy metals are generally already toxic to plants and animals, including humans. Including heavy metals that often contaminate habitat are Hg, Cr, Cd, As, and Pb. Heavy metal is a natural component of the soil. This element can not be degraded or destroyed. Heavy metals can enter into the human body through food, drinking water, or air. Heavy metals such as copper, selenium, or zinc are needed by the human body to help the body's metabolic performance. However, it can potentially become toxic if the concentration in the body is excessive. Heavy metals become dangerous due to the bioaccumulation system, which increases the concentration of chemical elements in living organisms.

Plants containing mercury when consumed can accumulate in the body. Mercury usually enters the human body through digestion. When there is more accumulation, it can result in degeneration of nerve cells in the cerebellum that control the nervous condition, disruption to the wide view, degeneration of the neural membrane and small brain parts. This element can be mixed with enzymes in the human body causing the loss of enzyme's ability to act as a catalyst for important body functions (Setiabudi, 2005). Death of a plant species can reduce the diversity of vegetation types in a landform. The diversity of plant species shows the diversity or variety of flora species from the lower growth, seedling, stake, pole, and tree (Syafei, 1990). Species diversity can be used to measure community stability, ie the ability of a community to keep itself stable despite disturbances to existing vegetation. According to Arrijani (2008), in general the presence of vegetation in a land form has a positive impact on the balance of ecosystems. Based on the above description, the purpose of this study is to determine the content of metal elements to the diversity of medicinal plants and their impact on human health.

## **METHOD**

The research method used is survey method (observation, measurement), and laboratory analysis. In the crop sampling using purposive random sampling method. This method is done by plot plot using wooden and raffia pathok with the size of plot for seedling, stake, pole, and tree respectively is 2x2 m; 5x5 m; 10x10 m; and 20x20m. Positioning and observation plot with GPS (Geographic Position System). Soil acidity level was measured using Soil Tester Takemura Electric Works LTD. The mercury content of the soil was measured using Mercury Survey Meter Brand NIC model EMP-2. Plants found in each observation plot were recorded by species name and number, measured stem diameter at breast height (1.3 m), and samples of plants wrapped with aluminum foil were labeled and then analyzed the content of As, Hg, and Mn with XRF (X-Ray Fluorescence) at XRF Laboratory Faculty of Earth Science and Technology Bandung Institute of Technology. The collected vegetation data were analyzed for diversity index using Muller-Dombois and Ellenberg (1974)

## **RESULTS**

### **The content of soil mercury and soil Ph**

The results of the measurement of mercury content on the soil ranged from 0.001 to 0.044 mg / m<sup>3</sup> and soil pH ranged from 4 to 6.8



**Table 1. The content of soil mercury and soil Ph**

No	Location	Soil pH	Soil Hg	
			(mg/m <sup>3</sup> )	(ppm)
1.	Tn 1	6,0	0,004	0,000004
2.	Tn. 2	5,0	0,021	0,000021
3.	Tn. 3	4,6	0,004	0,000004
4.	Tn. 4	4,8	0,001	0,000001
5.	Tn. 5	4,8	0,002	0,000002
6.	Tn. 6	6,2	0,002	0,000002
7.	Tn. 7	5,9	0,019	0,000019
8.	Tn. 8	4,5	0,036	0,000036
9.	Tn. 9	5,0	0,003	0,000003
10.	Tn. 10	6,6	0,002	0,000002
11.	Tn. 11	5,2	0,044	0,000044
12.	Tn. 12	5,8	0,001	0,000001
13.	Tn. 13	4,4	0,036	0,000036
14.	Tn. 14	4,8	0,001	0,000001
15.	Tn. 15	5,7	0,004	0,000004
16.	Tn. 16	6,2	0,003	0,000003

Description: 1mg / m<sup>3</sup> = 1/1000 ppm

#### The content of Mn, As, and Hg on Medicinal Plants

Result of analysis of Mn, As and Hg content of medicinal plants at study sites

**Table 2. Content of Mn, As, and Hg medicinal plants**

No.	Species	Mn (%)	As (%)	Hg (%)
1.	<i>Eugenia aromatica</i>	0,1143	< 0,0001	< 0,0001
2.	<i>Carica papaya</i>	< 0,0001	< 0,0001	< 0,0001
3.	<i>Curcuma domestica</i>	0,0089	< 0,0001	< 0,0001
4.	<i>Eugenia aperculata</i>	0,0057	< 0,0001	0,0149
5.	<i>Leucaena glauca</i>	0,0102	< 0,0001	0,0131
6.	<i>Zingiber officinale</i>	0,0176	< 0,0001	0,0095

Description: 1% = 10,000 ppm

Based on the results of analysis of Mn, As and Hg content in 6 species of medicinal plants (Table 2) showed Mn content ranges from <0.0001 - 0.1143%. The highest content of Mn found in *Eugenia aromatica* plant is 0,1143%. As <0.0001% content in all plant species. Hg content ranges from <0.0001 - 0.0149%. The highest content of Hg is found in *Eugenia aperculata* which is 0,0149%.

#### Diversity of Medicinal Plants

At the observation of vegetation at the location of the study found 6 types of medicinal plants as many as 144 individuals at the growth rate of seedlings, piles, poles, and trees. Calculation results of the medicinal plant diversity at seedling, stake, pole, and tree level in the study sites

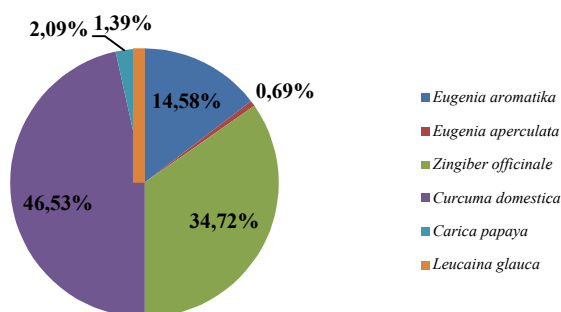
**Table 3. Diversity Index (H1) of Medicinal Plants at seedling, stake, pole, and tree**

No.	Growth Rate	H <sup>1</sup>
1.	Seeds	0,68255
2.	Shurbs	0,86759
3.	Poles	0,57832
4.	Trees	0,56233

Based on calculation of index value of *diversity* (H1) at seedling level, stake, pole, and tree (Table 3) ranged from 0.56233 - 0.86759 is low.

### Composition of Diversity of Medicinal Plants

The composition of plant medicinal diversity in the study sites consisted of *Eugenia aromatica*, *Carica papaya*, *Curcuma domestika*, *Eugenia aperculata*, *Leucaena glauca*, and *Zingiber officinale*



**Figure 2. Composition of Diversity of Medicinal Plants**

Based on the calculations (Figure 3), the highest sequence of composition of medicinal plants was *Curcuma domestica* 46.53%, *Zingiber officinale* 34.72%, *Eugenia aromatica* 14.58%, *Carica papaya* 2.08%, *Leucaena glauca* 1.39%, and *Eugenia aperculata* 0.69%.

## DISCUSSION

### The content of soil mercury and soil pH

According to Mirdat et al. (2013) soil mercury content is strongly influenced by soil pH. The mercury content of the soil at the study site is still below the threshold due to less than 0.5 ppm. This is in accordance with the opinion of Alloway and Ayres (1995) which states that the mercury content in the soil is said to exceed the threshold that is when more than 0.5 ppm. The low mercury content at the study site may be due to the low clay content of the soil. This is in accordance with the opinion of Alloway (1990) which states that clay fraction is an important soil properties in absorbing metallic elements. it is also affected by soil pH (Stennis, 1990).

The low low Hg content in the soil according to Fardiaz (1992) is also due to most of the heavy metal Hg disappearing from the soil, as it undergoes methylation into the form of volatile molecules and undergoes volatilization. Methylation is usually performed by anaerobic microorganisms and can also be associated with organic acids. Methylation is the transformation of inorganic mercury into methylated organic mercury by the activity of anaerobic microorganisms.

### The content of Mn, As, and Hg on Medicinal Plants

The mercury content in medicinal plants is high (<0.0001% -0.0149%) has crossed the threshold. This is in accordance with the opinion of Alloway and Ayres (1995) which states that the mercury content in the plant should be no more than 0.5 ppm. Six types of perennials found in the research sites belong to hyperlolerant plants. This is

in accordance with Widyati's opinion (2011) which states that a plant is said to have hyperolinary properties if the plant can thrive without undisturbed growth, because the plant has the ability to accumulate and translokasi heavy metals including mercury so that the growth of roots and buds does not experience obstacles. The content of mercury in *Eugenia aperculata*, *Leucaena glauca*, and *Zingiber officinale* is more than 10 ppm so that the plants are grouped in hyperaccumulator plant group. This is in accordance with the opinion of Hadiani (2009), which states that mercury hyperaccumulator plant is a plant that can accumulate mercury metal in a concentration of 10 ppm.

The content of Mn and As in medicinal plants in the study sites is also quite high. The high content of Mn, As, and Hg in these medicinal plants is probably due to the fact that the plant is a long-grown alteration area containing Mn, As, and Hg. Widyati (2011) states that the number of metal elements absorbed by plants depends on the type and age of the plant. It is also caused by environmental conditions, water content and nutrients at these locations that are used for the growth and development of these types of plants.

### **Diversity of Medicinal Plants**

The low level of diversity ( $H^1$ ) (0.56233 - 0.86759) (Table 6), indicates that the medicinal plant communities in the study sites have unstable levels of unstable species stability. This is probably due to environmental conditions, water content and nutrients in the soil is less able to support the growth and breeding of these plants. High species diversity shows that the community has a high complexity, because the interaction of species occurring within the community is very high. Communities are said to have low species diversity, if the community is composed by few species and if only a few species predominate (Indriyanto, 2008).

### **Composition of Diversity of Medicinal Plants**

The highest composition of medicinal diversity was *Curcuma domestica* 46,53%, *Zingiber officinale* 34,72%, *Eugenia aromatica* 14,58%, *Carica papaya* 2.08%, *Leucaena glauca* 1,39%, and *Eugenia aperculata* 0, 69%. *Curcuma domestica* and *Zingiber officinale* have high growth rates. This is due to several factors: the environment, the water content and nutrients in these locations strongly support the growth and proliferation of these plants.

### **Impact of Mn, As, and Hg Content On Medicinal Plants Against Human Health**

In low levels heavy metals are generally already toxic to plants and animals, including humans. Heavy metals become dangerous due to the bioaccumulation system, which increases the concentration of chemical elements in living organisms. Heavy metals can enter into the human body through food, drinking water, or air. The effect of Mn, As, and Hg on human health (Widowati et al., 2008), as follows:

#### **Manganese (Mn)**

Mn is an essential micronutrient for humans, plants and animals. Mn toxicity usually occurs through inhalation exposure with symptoms of permanent interference of the extrapyramidal nervous system, psychiatric disorders and cirrhosis of the liver.

#### **Arsenic (As)**

As micronutrients are needed by living things, but use in large doses is toxic. As is carcinogenic, mutagenic and teratogenic. Peroral exposure may increase the risk of skin cancer, lung, bile, liver, kidney and prostate, while through inhalation can cause lung cancer. Non-cancer toxicity of As includes thickening skin, skin discoloration, stomach pain, vomiting, diarrhea, numbness of hands and feet, partial paralysis and blindness.

#### **Mercury (Hg)**

Hg forms that enter into the environment include: (1) Inorganic hg derived from rainwater or river flow and is stable at low pH. Inorganic Hg compounds, such as Hg (NO<sub>3</sub>). (2) HgCl<sub>2</sub> and HGO will be accumulated in liver, kidney and brain organ. The inorganic Hg toxicity includes nervous system disorders, such as tremor, tooth failure and loss, anemia, albuminuria, and other symptoms of kidney damage and intestinal mucosal damage. (3) Organic hg such as phenyl mercury (C<sub>6</sub>H<sub>5</sub>-Hg), metal mercury (CH<sub>3</sub>-Hg) which can come from agriculture that is pesticide. The toxicity of organic mercury includes damage to the central nervous system of anorexia, ataxia, dismetria, eye disorders, blindness, convulsive hearing loss, degeneration and necrosis, neurons and coma and death.

## CONCLUSION

1. The diversity of medicinal plants in the study sites has a low level of stability of species diversity.
2. The content of metal elements Mn, As, and Hg on medicinal plants in the study sites has exceeded the threshold.
3. Mn, US, and Hg metals contents cause health problems in humans.

## REFERENCES

- Absissalam R., S. Bronto, A. Harijoko, dan A. Hendratno. 2009. *Identifikasi Gunungapi Purba Karangtengah di Pegunungan Selatan, Wonogiri, Jawa Tengah*. Jurnal Geologi Inonesia, Vol 4 (4):253-267.
- Agustina, D.K. 2008. *Studi Vegetasi di Hutan Lindung RPH Donomulyo BK PH Sengguruh KPH Malang*. Skripsi tidak diterbitkan. Malang: Jurusan Biologi Fakultas Saintek UIN Mau-lana Malik Ibrahim.
- Alloway. 1990. *Soil Processes and Behaviour of Metals*. In *Alloway (Ed). Heavy Mettals in Soils*. New York. Blackie Glasgow and London Halsted Press. John Wiley and Sons, Inc.
- Alloway, B.J and Ayres, D.C. 1995. *Chemical Principle of Environmental Pollution*, 2nd Edition, London. Blackie Academic and Professional, Chapman & Hall.
- Arrijani. 2008. *Struktur dan komposisi vegetasi zona montana Taman Nasional Gunung Gede Pangrango*. Biodiversitas 9 (2): 134-141.
- Fardiaz, S. 1992. *Polusi Air dan Udara*. Yogyakarta. Kanisius.
- Hardiani, Henggar. 2009. *Potensi Tanaman Dalam Mengakumulasi Logam Cu Pada Media Tanah Terkontaminasi Limbah Padat Industri Kertas*. Jurnal BS. Vol: 44(1): 27- 40
- Maryantika, N., Lalu, M.J., Andie, S. 2010. *Analisa Perubahan Vegetasi Ditinjau dari Tingkat Ketinggian dan Kemiringan Lahan Menggunakan Citra Satelit Landsat dan Spot 4 (Studi Kasus di Kabupaten Pasuru-han)*. (Online), (repository.its.ac.id/bitstream/...pdf) Diakses pada 30 Maret 2013.
- Mirdat, Yosep S Patádungan, Isrun. 2013. *The Level Of Heavy Metal Of Mercury (Hg) In Soil Of Agricultural Area round. Gold Mining In Poboya, Palu*. e-J. Agrotekbis 1 (2) : 127-134.
- Putranto, T. T. 2011. *Pencemaran Logam Berat Merkuri (Hg) pada Air*

*Tanah*. Teknik. Vol. 32, No. 11. Hal: 62-71

- Setiabudi, B.T. 2005. *Penyebaran Merkuri Akibat Usaha Pertambangan Emas Di Daerah Sangon*. D.I Yogyakarta. Kabupaten Kulon Progo.
- Steinnes, E. 1990. *Mercury*. In B.J. Alloway (ed). *Heavy Metals in Soil*. Blackie Glasgow and London Halsted Press. New York. John Wiley, Sons Inc.
- Suproborini, A. 2017. *Dampak Penambangan Emas Rakyat Terhadap Kandungan Hg Tanah, Air, Tanaman, Struktur dan Komposisi Vegetasi Di Dusun Mesu Desa Boto Kecamatan Jatiroto Kabupaten Wonogiri*. Tesis. Surakarta. Pascasarjana Universitas Sebelas Maret.
- Susanto, W. 2012. *Analisis Vegetasi pada Ekosistem Hutan Hujan Tropis untuk Pengelolaan Kawasan Taman Hutan Raya, Raden Soerjo Wilayah Pengelolaan Cagar-Kota Batu*. (online), 30/ 03/2013
- Syafei. 1990. *Dinamika Populasi. Kajian Ekologi Kuantitatif*. Jakarta: Pustaka Sinar Harapan
- Widowati W, Sastiono A, Jusuf R. 2008. *Efek Toksik Logam: Pencegahan dan Penanggulangan Pencemaran*. Yogyakarta. Andi Offset .
- Widyati. 2011. *Potensi Tumbuhan Bawah Sebagai Akumulator Logam Berat Untuk Membantu Rehabilitasi lahan Bekas Tambang*. Jurnal Mitra Hutan Tanaman Vol: 6 (2): 46-56.