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Revision According to Reviewer #1: MS no. WATE-D-20-00179

The authors have presented in this manuscript "Accumulation of Lead (Pb) in the Lichen Thallus of Mahogany Trees in Medan City Road". There are some problems with the abstract, introduction, materials and methods, results and discussion, and conclusion which need to be considered to change. On the other hand, there are some mistakes in English grammar which must be improved. Below I indicate my detail observations and comments.

Respond: The author already checked the grammar.

Abstract

The authors should mention briefly the background of this study.

Respond: the background of this study was added with red color text

Introduction

The authors should describe more clearly why lead is selected as a parameter in this study. Why not other metals? Where does Pb come from? Because now fuel is generally free of Pb. Is there any information about the concentration of Pb in the air in those areas?

Respond: the explanation was added (indicated by the red color text)

The unit of μgg^{-1} should be replaced with $\mu\text{g.g}^{-1}$.

Respond: It has been replaced in all text.

Materials and methods

a. This part should be written in more detail.

b. How long the research was conducted?

Respond: It was added added (indicated by the red color text)

c. Why the lichens were sampled from the mahogany trees? In each sampling area, the lichens were taken from 20 mahogany trees?

d. What was the method of metal analysis in the lichens?

e. The coverage of lichens (density/abundance) on the trees was also measured?

f. For data analysis, why not using anova for Pb? The authors should determine the Pb concentrations in each Lichen species (n=3).

Respond: All answers for the questions were added (indicated by the red color text)

Results and discussion

a. The unit of mcg/gram means $\mu\text{g/g}$?

b. Below Table 3, this statement is correct? Tolerant species can be used as an indicator of accumulation to detect the pollutant levels, especially in the air.

c. Is it correct to correlate the Pb concentrations in the lichens with traffic density? Because at the medium traffic, the concentration of Pb in *Parmelia saxatilis* was higher than at high traffic.

Respond: All answers for the questions were added (indicated by the red color text)

Conclusions

The authors should write the conclusions more condensed and relate directly back to the problems/questions stated in the introduction.

Respond: *The conclusion was revised according to the suggestion of reviewer.*

Water, Air, & Soil Pollution

Accumulation of Lead (Pb) in the Lichen Thallus of Mahogany Trees in Medan City Road

--Manuscript Draft--

Manuscript Number:	WATE-D-20-00179R1
Full Title:	Accumulation of Lead (Pb) in the Lichen Thallus of Mahogany Trees in Medan City Road
Article Type:	Full research paper
Keywords:	Accumulation of Pb, Thallus, Lichens, Tree Stands
Corresponding Author:	Ashar Hasairin Universitas Negeri Medan Medan, Sumatera Utara INDONESIA
Corresponding Author's Institution:	Universitas Negeri Medan
First Author:	Ashar Hasairin
Order of Authors:	Ashar Hasairin Nursahara Pasaribu Rosliana Siregar
Funding Information:	
Abstract:	<p>Rapid growth of vehicles in Medan, Indonesia is one of the causes in the increasing of air pollution, in which approximately 85% is contributed merely by vehicles. On the other hand, the use of lead-based fuel in motor vehicle increases the air contamination in Medan. This study aimed to obtain an accumulation of lead (Pb) in the thallus of lichens in mahogany trees in four different locations in Medan, Sumatera Utara, Indonesia in which the lichens act as bioindicator of air contamination as well as measuring the lichens-lead correlation and traffic densities. Purposive sampling location was determined based on the traffic density level with different air pollutions; the location which was far from traffic circulation was used as the control. The analysis of Pb was conducted using atomic absorption spectrophotometry (AAS). The data were analyzed descriptively to discover and compare Pb accumulation between each location with different traffic density levels. The result showed that there were 11 species of 7 genera and 7 families with two types of the thallus (foliose and crustose) in mahogany trees. The traffic density level influenced the diversity of lichens as the traffic density was quite significant with the number of lichen types. The levels of Pb and traffic density correlated very significantly at the level of $\alpha = 0.01$ for <i>Parmelia saxatilis</i>, <i>Lepraria incana</i>, <i>Pertusaria amara</i> type, while <i>Opegrapha atra</i> had a significant correlation. The accumulation of Pb in the thallus of <i>Pertusaria amara</i> ranged from 5.23 to 15.07 $\mu\text{g/g}$, whereas medium in <i>Lepraria incana</i> ranged from 1.19 to 4.88 $\mu\text{g/g}$. Thus, <i>Pertusaria amara</i> which had greater Pb level than <i>Lepraria incana</i> had the potential as a resistant bioindicator. The correlation analysis of Pb levels and traffic density showed that <i>Pertusaria amara</i> had a significantly high correlation compared to <i>Parmelia plumbea</i>, <i>Parmelia glabratula</i>, and <i>Graphis scripta</i>. Furthermore, <i>Lecanora conizoides</i> was a tolerant bioindicator of air pollution whereas <i>Parmelia saxatilis</i> had the potential to be a tolerant bioindicator.</p>
Response to Reviewers:	<p>Revision According to Reviewer #1: MS no. WATE-D-20-00179</p> <p>The authors have presented in this manuscript "Accumulation of Lead (Pb) in the Lichen Thallus of Mahogany Trees in Medan City Road". There are some problems with the abstract, introduction, materials and methods, results and discussion, and conclusion which need to be considered to change. On the other hand, there are some mistakes in English grammar which must be improved. Below I indicate my detail observations and comments.</p> <p>Respond: The author already checked the grammar.</p> <p>Abstract</p>

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Conclusions

The authors should write the conclusions more condensed and relate directly back to the problems/questions stated in the introduction.

Respond: The conclusion was revised according to the suggestion of reviewer.

Additional Information:

Question

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Does the article report existing science applied to a local situation?	Yes
If yes, how is this research significant to furthering worldwide knowledge on this topic	Current research on the use of bioindicators in monitoring the presence of air pollution is still limited; thus, in-depth studies should be done about the ability of lichens to be used as a bioindicator of air pollution. This research, therefore, aimed to investigate the accumulation of Pb in the thallus of lichens in mahogany trees at four different sites based on the traffic density and air pollution levels in which the site located far from the traffic circulation was used as the control. Therefore, it would give a new approach on the research of environmental science
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Accumulation of Lead (Pb) in the Lichen Thallus of Mahogany Trees in Medan City Road

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Abstract

Rapid growth of vehicles in Medan, Indonesia is one of the causes in the increasing of air pollution, in which approximately 85% is contributed merely by vehicles. On the other hand, the use of lead-based fuel in motor vehicle increases the air contamination in Medan. This study aimed to obtain an accumulation of lead (Pb) in the thallus of lichens in mahogany trees in four different locations in Medan, Sumatera Utara, Indonesia in which the lichens act as bioindicator of air contamination as well as measuring the lichens-lead correlation and traffic densities. Purposive sampling location was determined based on the traffic density level with different air pollutions; the location which was far from traffic circulation was used as the control. The analysis of Pb was conducted using atomic absorption spectrophotometry (AAS). The data were analyzed descriptively to discover and compare Pb accumulation between each location with different traffic density levels. The result showed that there were 11 species of 7 genera and 7 families with two types of the thallus (foliose and crustose) in mahogany trees. The traffic density level influenced the diversity of lichens as the traffic density was quite significant with the number of lichen types. The levels of Pb and traffic density correlated very significantly at the level of $\alpha = 0.01$ for *Parmelia saxatilis*, *Lepraria incana*, *Pertusaria amara* type, while *Opegrapha atra* had a significant correlation. The accumulation of Pb in the thallus of *Pertusaria amara* ranged from 5.23 to 15.07 $\mu\text{g/g}$, whereas medium in *Lepraria incana* ranged from 1.19 to 4.88

$\mu\text{g/g}$. Thus, *Pertusaria amara* which had greater Pb level than *Lepraria incana* had the potential as a resistant bioindicator. The correlation analysis of Pb levels and traffic density showed that *Pertusaria amara* had a significantly high correlation compared to *Parmelia plumbea*, *Parmelia glabratula*, and *Graphis scripta*. Furthermore, *Lecanora conizoides* was a tolerant bioindicator of air pollution whereas *Parmelia saxatilis* had the potential to be a tolerant bioindicator.

Keywords : Accumulation of Pb, Thallus, Lichens, Tree Stands

Introduction

Environmental problems become increasingly uncontrolled, especially in Medan, Indonesia. This is due to the rapid increase in the number of public and private vehicles, followed by the growth of development. The growth of the industrial and transportation sectors has an impact on environmental degradation. Motorcycles are one of the main sources of air pollution because they contain various harmful contaminants for humans. Imperfect combustion from motor engines and industrial manufacturing has been producing contaminated materials including black smoke, carbon monoxide, nitro oxide, sulphide oxide, hydrocarbon, phosphorus constituents, and lead (Sastrawijaya, 2009).

One of the most dangerous sources of pollutants to living things is lead (Pb). Lead is a hazardous material which is harmful both for human and environmental features. These metals enter the human body through respiratory and digestive systems or directly through the skin surface. The largest contributor to Pb pollution in the air is the transport sector. Fergusson (Fergusson, 1990), Dahlan (Dahlan, 1992), and Asmiwyati (Asmiwyati, 2012) state that motor vehicles are the main source of Pb that pollutes the air in urban areas. Lead is also considered as the main metal pollutants within the air (Jamhari, 2014). It is estimated that about 60 to 70% of Pb particles in urban air come from motor vehicles, and about 75% of Pb added to fuel oil will be emitted back into the atmosphere (O'Neill, 1993). Furthermore, Fergusson (Fergusson, 1990) states that Pb released from motor vehicles averages 0.02-0.05 μm . When the particle size becomes smaller, the duration of attachment will also be longer. In term of "Premium" and "Pertalite" which is one of the Indonesian fuel products, have been investigated to contain amounts of lead, which probably is emerged during the processing stages. (Mairizon, 2019). Although the bans in using the Tetraethyllead (TEL) for the processing of "Premium" has been issued, the lead contents only decrease from 0.3 g/l to 0.0013 g/l. Subsequently, this lead content is not considered as safety amount, even though the amount is reduced to be 0.001