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Accumulation of Lead (Pb) in the Talus Lichenes Contained in Mahogany Tree Stands of Roadside of Medan City

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Abstract

This study reports on the accumulation of lead (Pb) in *the talus Lichenes* found on roadside stands of mahogany trees in the city of Medan, North Sumatra, Indonesia. Samples were taken by purposive, ie location based on the level of traffic density with different air pollution. Pb analysis was performed using Atomic Absorption Spectroscopy (AAS). Identified as many as 8 kinds of Lichens with 2 types, namely *talus Crustose* and foliose. Type of *Lepraria incana* and *Pertusaria amara*, which is found in the three study sites belonging to the cosmopolitan types. Pb accumulated in the *talus Pertusaria amara* ranged from 5.23 to 15.07 ppm. Being on *Lepraria incana* ranged 1.19 to 4.88 ppm. *Pertusaria amara* much larger than the *Lepralia incana*, have potential as bio-indicators of resistance. *Lichenes Pb* correlation with traffic density showed *Pertusaria amara* has a very high level and significant correlation compared with other types.

Keyword: Accumulation of Pb, *talus*, *Lichenes*, tree stands

1. Introduction

Environmental problems, especially in urban areas from day to day getting out of control. This is due to the increasing industrial development and transportation. The growth of industry and transport increases in Medan, impact on environmental degradation. One of the sources of pollutants are very harmful to living beings is lead (Pb). These metals enter the human body through the respiratory and digestive systems. Pb biggest polluters in the air is the transport sector. Motor vehicles are a major source of *Pb* that pollute the air in urban areas. An estimated 60 to 70% *Pb* particles in urban air comes from motor vehicles, and roughly 75% of *Pb* is added to the fuel will be emitted back into the atmosphere (Dahlan, 1992; O'neil, 1993). *Lead* (Pb) contained in the air, which is the result of motor vehicle exhaust emissions, can accumulate in the body tissues of living things, especially on *talus Lichens*. This is a good indicator of air pollution (Bargagli et al., 1987).

In the area of Tuscany-Italy, the concentration of *Pb* in the *talus Lichenes* there are 13.2 µgg-1 dry weight. Highest concentration of *Pb* was found in the area around the vehicle parking area and near the highway. Accumulation of *Pb* in *Parmelia physodes* decreased proportionally to the distance away from the highway (Kovacs, 1992). Deruelle research results (1981) also showed that at a distance of 15 m from the highway accumulation of *Pb* was found in 1002 as µgg-1 dry weight, while at a distance of 600 m from the highway only 65 µgg accumulation of *Pb-1* dry weight.

The level of air pollution in urban areas can be tested with a bio indicator to determine the air quality. Bioindicator is an organism whose presence can be used to detect, identify and qualify environmental pollution (Conti & Cecchetti 2000; Sudirman, 2009). Research the use of bio-indicators in monitoring air pollution is still limited, so it needs to be studied more in depth lichens that can be used as bio-indicators of air pollution. Information about the environmental quality of air in the city of Medan - North Sumatra - Indonesia is illustrated by the findings of accumulation of *Lead (Pb)* in *Lichens Talus* at roadside stands of mahogany trees.

2. Method

Location is the object of this study were taken by purposive based on the level of traffic congestion and air pollution are different in the city of Medan. The location is divided by three categories, namely (1) The area of high traffic density, (2) Regional traffic levels are, (3) Regional traffic levels are low. Traffic density measurements is done by calculating the total motor vehicles passing through the counting station using a hand tally counter. Then proceed with sampling *Lichens* on bark surface of the mahogany tree. Samples identified in Plant Taxonomy Laboratory, Department of Biological Science, State University of Medan and *Pb* analysis conducted at the Laboratory of Pharmaceutical North Sumatra University using Atomic Absorption Spectroscopy (AAS). Data were analyzed descriptively to determine and compare the accumulation of Pb between the location of the traffic levels are different.

3. Results and Discussion

Lichenes contained in the Standing Mahogany

Corticolous is kind of *Lichenes* that live on the bark of trees. This species is very limited to the tropics and subtropics, the most humid environmental conditions. Existing *Lichens* on trees generally grow on the trunk or lower part of the stem (Fink, 1961). Exploration results *Lichens* on tree stands of mahogany three sampling sites, found as many as 897 samples of *Lichens* which includes 8 species and 5 families. Lichens are classified into 2 types talus, namely: the type of *Foliose* (leaf resembles the structure of the talus, often found green to grayish green) of 3 types. Type of *Crustose*, crust layer structure of the Talus as firmly attached to the substrate with the talus colors vary by 5 types. Medium type of *Squamulose* and fructicose is not found. Type of *Lichens* are found throughout the study sites shown in Table 1.

Table 1. Number of type of *Lichenes* found in all locations observations

No	Species Name	Family (suku)	Type Talus	Location / Total of *Talus*			
				I	II	III	Total
1	*Lepraria sp.*	*Leprariaceae*	*Crustose*	-	32	-	32
2	*Parmelia sp.*	*Parmeliaceae*	*Foliose*	-	3	9	12
3	*Parmelia glabratula*	*Parmeliaceae*	*Foliose*	-	8	19	27
4	*Parmelia saxatilis*	*Parmeliaceae*	*Foliose*	60	10	-	70
5	*Lepraria incana*	*Leprariaceae*	*Crustose*	64	45	155	264
6	*Graphis scripta*	*Graphidaceae*	*Crustose*	-	87	154	241
7	*Opegrapha atra*	*Opegraphaceae*	*Crustose*	-	7	13	20
8	*Pertusaria amara*	*Pertusariaceae*	*Crustose*	3	52	176	230
Total of *Colonies* per location				127	244	526	897
Mean				15,87	30,50	65,75	112,12
Deviation Standard				28,50	29,52	79,94	
Percentage presence of *Lichenes* (%)				5,87	11,27	24.29	100

Description: Location I. Jl. Yos Sudarso Medan; Location II. Jl Sudirman Medan; Location III. Jl. Cik Ditiro Medan

There are 6 genera and 8 species of *Lichens* were obtained. Type of *Lepraria incana* and *Pertusaria amara* is found in the three study sites. The types of these *Lichens* belonging to the cosmopolitan and tolerant type because it can be found throughout the observation location. The number and types of *Lichens* are very varied. Each type of *Lichens* were found to have characteristics that are so diverse between one species and another. It can be noted from the start of the *Talus* type, shape, color, surface and other characteristics. *Lichens* have morphological characteristics and properties are different from one another.

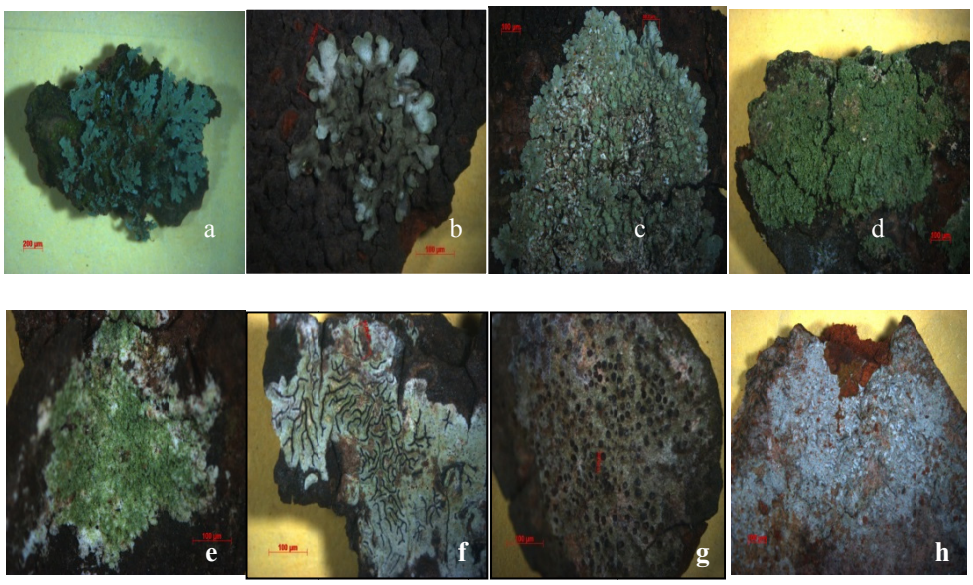
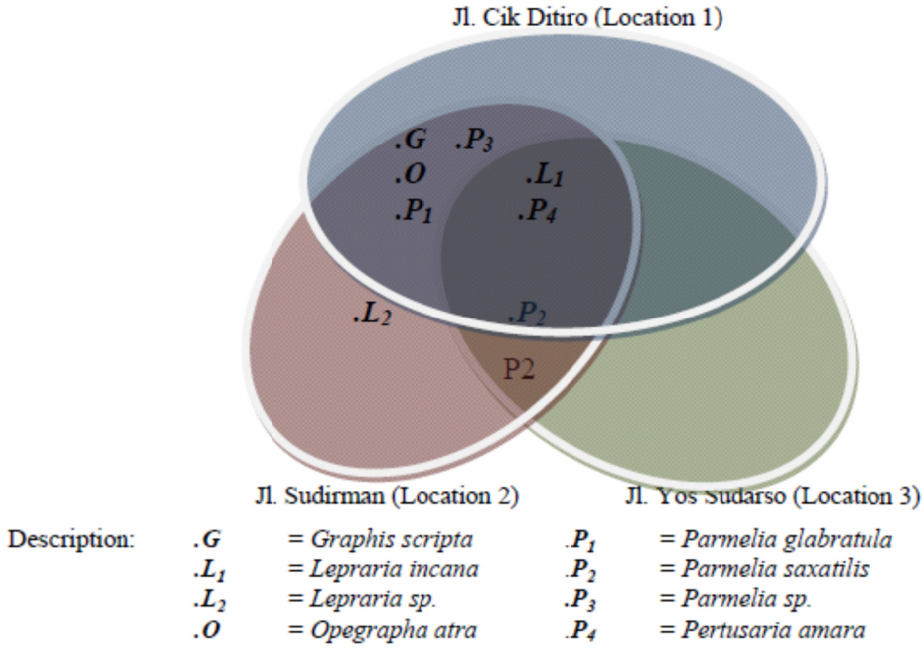


Figure 1. Type of *Lichens* are found throughout the study site, namely: a. *Parmelia grabatula*; b. *Parmelia saxatilis*; c. *Parmelia sp*.; d. *Lepraria incana*; e. *Lepraria sp*.; f. *Graphis scripta*; g. *Opegrapha atra*; h. *Pertusaria amara*

Lichenes diversity of different proportions in each study site, due to contaminated areas with a density of motor vehicles. Types of *Lichens* are found in *Swietenia* mahogany tree on Jl. T. Cik Ditiro Medan, Jl. Sudirman Medan and Jl. Yos Sudarso Medan, is as many as eight types. It appears that there are variations in the number and types of *Lichens* for each study site. It shows that there are differences in the tolerance level of *Lichens* on the level of air pollution. That difference can simply be shown in the following diagram.



Metal accumulation *Pb* at *Tallus Lichens*

Lichens exploration results at the three sampling sites, indicating that there are differences in the level of tolerance of *Lichens* to air pollution levels (Table 1). It is characterized by differences in the type and amount of

Lichens are found in each of the sampling sites, with the accumulation of pollutants *Lead (Pb).*

Table 2. Pb metal accumulation in Tallus Lichens in Medan

No	Type of *Talus*	Species Name	Timbal content (mcg/gram)		
			Location 1	Loction 2	Location 3
1.	*Crustose*	1. *Lepraria sp.*	-	46,39	-
	Crustose	2. *Lepraria incana*	4,88	4,88	1,19
	Crustose	3. *Grafis scripta*	-	20,47	0,95
	Crustose	4. *Opegrapha atra*	-	0,47	<0,02
	Crustose	5. *Pertusaria amara*	14,43	15,07	5,23
2.	*Foliose*	6. *Parmelia sp.*	-	44,99	19,99
	Foliose	7. *Parmelia glabratula*	-	29,82	38,04
	Foliose	8. *Parmelia saxatilis*	21,37	33,82	-

Description: Location 1. Jl. Yos Sudarso, Medan; Location 2. Jl.. Sudirman, Medan; Location 3. Jl. Cik Ditiro, Medan

Pb accumulated in the *talus Pertusaria amara* ranged from 5.23 to 15.07 ppm. In *Lepraria incana* is ranged from 1.19 to 4.88 ppm. Type of *Lichens* belonging to the cosmopolitan and tolerant type because it can be found throughout the observation location *Lepraria incana* and *Pertusaria amara*. This type classified as the most resistant type of presence both in the percentage of clean air and polluted air. According Panjaitan et al (2010) Family of *Leprariaceae* characterized by talus characteristics resembling flour, spread unevenly, with margins that form small lobes and pale green to whitish yellow.

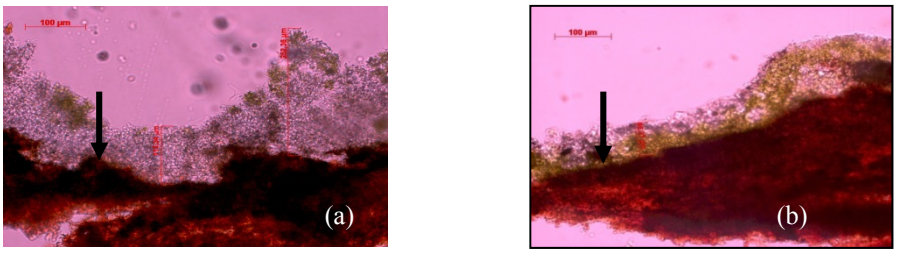


Figure 2. (a) *Lepraria incana* dan (b) *Pertusaria amara* and arrows sign indicate location of accumulates particles lead (Pb)

Particle accumulation of *Lead (Pb)* in *Lepraria incana* and *Pertusaria amara* shown with blackish brown stain under a layer of algae seen in the upper part of the cortex. Type of *Lepraria incana* were found in all study sites, including the type that easily adapt to poor air quality conditions. Use of *Lepraria sp*. as bioindicator of air pollution ever undertaken in the city of Bandung (Taufikurahman et al., 2010). *Lichens* sensitivity to air pollution can be seen through changes in its diversity and accumulation of pollutants in its' talus. Meanwhile, according to Ohmura et. al (2009) type of lichen is very sensitive to sulfur dioxide (SO_2) and can only live in areas with clean air quality.

Further research of Lichenes crustose types is found as many as 5 types are more than the *Foliose* types. *Crustose Lichens* survive stronger than other types. This is due to a smaller flat *Crustose*, thin strongly attached to the *Corticoleus* (bark). *Crustose* has been used in Japan as a bioindicator of air pollution. McCune (2006) said Lichens crustose considered more tolerant of air pollution as it has the structure of the talus is relatively simple compared to other types of *Lichen Talus*. Type of *Tolerant Lichens* can survive in areas with environmental conditions where the air is polluted. Meanwhile, Lichens are sensitive types can not usually be found in areas with poor air quality. Lichens difference sensitivity to air pollution related to the ability to accumulate pollutants (Conti & Ceccheti, 2000).

Lichens are found to have a type derived from the *Talus Foliose Parmeliaceae* family. *Parmeliaceae* family is the largest group of *Foliose Lichens* have a specific form of the *Talus* and easily recognizable. Its' *Talus* has upper and lower cortex, there is often rizin to help adhesion to the substrate. *Lichens* found are the type of *Parmeliaceae* family, namely *Parmelia caperata*; *Parmelia glabratula*; *Parmelia saxatilis*; and *Parmelia sp*. Also note that there are different levels of *Pb* content in the *Talus Lichens Lepralia incana* and *Pertusaria amara*. *Amara Pertusaria Pb* concentration is much greater than the *Lepralia incana*, means *Pertusaria amara* which have potential as bio-indicators of resistance that can be found in various areas with different levels of air pollution.

Several types of *Lichenes* are sensitive to pollutants in the air so rarely found in polluted areas. The types are more tolerant of pollutants can accumulate a certain amount to the extent of concentration that can be tolerated. The types that are tolerant can be used as an indicator to detect the levels of accumulation of pollutants contained in the air especially. Metals are absorbed by *Lichens* accumulate in tissues its' *Talus*. *Lichens talus* structure is one of the factors that affect the efficiency of absorption of the metal. According Kinaliouglu et. al (2010) that the efficiency level of accumulation of pollutants at successive *Talus* is *Foliose* > *Crustose* > *Fruticose*. Furthermore Scerbo et. al (2002) said that causes extensive talus surface *Foliose Lichens* have greater contact with pollutants so that the accumulation of pollutants is more efficient than other types of *Talus*. *Foliose Lichen* id also called leafy *Lichens*, has extensive talus structure and can be easily removed from the substrate. *Foliose* types found in this study are in some kind of *Parmelia sp*.

In addition to traffic levels, abiotic conditions were also measured to determine the specific environmental conditions of the habitat Lichens, including air temperature, air humidity and light intensity of the wind speed. Measurement of environmental factors in the three study sites shown in Table 3.

Table 3. Environmental parameters measurement result data of each location

No	Parameter	Location			Total	Mean
		I	II	III		
1.	Traffic density Vehicles / hour	15909	8893	7765	32567	10855
2.	Humidity (%)	77	79	81	237	79
3.	Temperatures (ºC)	27,6	27,8	27,9	83,3	27,76
4.	The intensity of light (Lux)	500	371	241	1112	370,66
5.	The wind speed (m/s)	2,9	1,8	1,6	6,3	2,1

Description: Location1. Jl. Yos Sudarso, Medan; Location 2. Jl.. Sudirman, Medan; Location 3. Jl. Cik Ditiro, Medan

Traffic levels and environmental factors were measured at the three sampling locations vary from each other. The high level of traffic congestion caused because it is situated. The position or location of the road are different causes of traffic levels at each observation location. Location 1 is the protocol that is located on various streets and lanes every day is always filled by a current motor vehicle. Therefore, this location has traffic levels are high compared to most other locations.

Location 2 is located in the city center adjacent to the location 3 with lane specific, the number of vehicles crossing this location is less than 1, while locations 3 locations located in schools and offices that are low traffic access. This led to the location 3 has traffic levels are low compared to most other observation location. These considerations were taken to determine the quality of the environment that may be affected by each type of vehicle exhaust gases passing at that location. According Nursal, et al (2005) the high density of traffic is one of the sources of Pb pollution in the air.

When linked with the accumulation of *Pb* were measured on the talus Lichenes obtained from each location turns on the *Talus Lichens Pb* accumulation correlates with the level of traffic congestion and other environmental factors were measured. Power accumulation of Pb in each type Lichens are not the same, even certain types have a high accumulation of power. Pertusaria amara has a very high correlation levels than other types.

Environmental factors including humidity, air temperature, light intensity and wind speed had greater influence on the accumulation of *Pb* in the *Talus Lichens* compared to other measurable factors. This relates to the nature of life and growth of the *Talus Lichens* are better suited to the more humid air conditions. Humidity and air temperature at the three study sites are not much different, compared with the light intensity and wind speed. According Nursal, et al (2005) in a more humid environment *Lichens* can live better and fertile, so that the absorption of water, minerals and accumulation of pollutants become more effective and much more.

In Table 3 it appears that the air temperature is relatively the same, while the intensity of light at each study site showed varying numbers, the highest light intensity is at location 1 of 500 Joules, decreased at location 2 is 371 Joules; location 3 is 241 Joules. Air humidity showed numbers vary at each study site, the most humid area is the location of 1 is 81%, decreased in 3 locations namely 79%, location 2 is 77%. Meanwhile, according to Noer (2004) in Pratiwi (2006) which states lichens like dry place with air humidity 40% - 69%. Average air humidity above that range. For wind speed, location 1 showed a higher rate than the two other studies tage location 2, and 3 are relatively similar locations respectively are 1.8 m /s and 1.6 m /s.

Lichenes habitat characteristics for each study site when compared with conditions during the last five years (2009-2013) are relatively constant. Lichens krakteristik habitat conditions in detail attached at the end of this paper. The following section describes the characteristics of the habitat conditions lichens in July between the years 2009-2013. For location 3, the air temperature for the month of July during the year 2009-2013 are among $27,70^0$ C - $28,20^0$ C, with humidity between 79% -83%, the intensity of light in the month of July 2013, declined to 34% compared to the previous four years (2009-2012) is between 50% - 67%, the wind speed is between 1,05m/s - 1,80 m/s. For location 2, the air temperature is in the range $27,30^0$ C - $27,90^0$ C, with humidity between 77% -79%, the intensity of light reaching 60% in 2011 and further decreased to 41% in 2013, indicating an increase in wind speed is significantly from the year 2009 that 1,40 m/s to 3,26 m/s in 2012, then decreased to 3,18 m/s in 2013 to location 1, the air temperature is in the range of between $27,30^0$ C - $27,70^0$ C, with humidity between 80% - 84%, light intensity 47% - 69%, the wind speed in 2009 is 0,90 m/s, decreased to 0,10 m/s in 2010, then continued to increase until 2013, that is 1.40 m/s.

Ambient Air Quality

Content of ambient air measurements at each study site is intended to describe the pollution level three regions. Parameters were observed, namely CO, CO_2, NO_2, and SO_2. These measurements were performed by Environmental Health and Engineering Center for Disease Controling (EHECDC) Class I Medan. Content of the ambient air measurement results can be seen in Table 4 below.

Table 4. Content of ambient air in location research

No	Parameter	Ambien air quality			Absolut quality
		Lokasi 1	Lokasi 2	Lokasi 3	
1	*Carbon monoksida (CO)*	14,00	10,00	9,00	29 ppm
2	*Nitrogen Oksida (NO_2)*	9,55	32,17	31,44	400 µg/m³/jam
3	*Sulfur dioksida (SO_2)*	11,55	32,38	6,10	900 µg/m³
4	*Carbon dioksida (CO_2)*	3.300,00	2.150,00	1.800,00	-

Description:

Location 1. Jl. Yos Sudarso (high traffic density)

Location 2. Jl.Sudirman (medium traffic density)

Location 3. Jl. Cit Ditiro (low traffic density)

Ambient air sampling was conducted at three locations during the day at 09:30 pm to 12:00 pm on September 12, 2013, which the transport activity is expected to contribute to the ambient air in the surrounding environment. Measurement of value content of the ambient air samples with parameters of carbon monoxide (CO), nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) and carbon dioxide (CO_2) is still far below the air quality standard threshold according to Government Regulation No. 41 of 1999.

Based on the measurement results, the location of the ambient air contains carbon monoxide (CO) and carbon dioxide (CO_2) in a row from the top is the location area 1 (high traffic density) followed by location 2, (medium

traffic congestion) and location 3 (low traffic density). CO and CO_2 measurement results demonstrate significant value in the three study sites and shows a striking comparison of values in a row. This parameter indicates the level of pollution that contrast.

Overall, the results of these measurements indicate that the relative location of the three regions with the lowest level of pollution and the location 1 is the area with the highest contamination levels among the three study sites. While the location of which 2 are medium or moderate level of contamination. The level of pollution is also linked to the volume of vehicles passing in each study site.

Lichenes Correlation with Physical Properties of Growing Media and Ambient Air

Correlation analysis performed lichens namely: 1) *Lichens* with ecological characteristics (physical factors of environmental chemistry); 2) *Lichens* with ambient air. Spearmans Correlation Analysis with SPSS computerized method 18 shown in Table 5 below.

Table 5. Correlation analysis in location research Lichenes

Location	No	Species name	Lichenes Correlation with Physical Properties of Growing Media			Lichenes Correlation with Ambient Air		
			r	**A**	**B**	**r**	**A**	**B**
1	1	*Parmelia saxatilis*	-0,320	VL	NSig	0,553	S	Sig
	2	*Lepraria incana*	-0,437	VL	NSig	0,568	S	Sig
	3	*Pertusaria amara*	-0,470	VL	NSig	0,555	S	Sig
2	1	*Lepraria sp.*	0,500	S	Sig	0,302	L	Sig
	2	*Parmelia sp.*	0,626	H	Sig	0,213	L	Sig
	3	*Parmelia glabratula*	0,614	H	Sig	0,441	S	Sig
	4	*Parmelia saxatilis*	0,294	L	Sig	0,388	S	Sig
	5	*Lepraria incana*	0,394	L	Sig	0,234	L	Sig
	6	*Grafis scripta*	0,560	S	Sig	0,537	S	Sig
	7	*Opegrapha atra*	0,550	S	Sig	0,486	S	Sig
	8	*Pertusaria amara*	0,437	S	Sig	0,459	S	Sig
3	1	*Parmelia sp.*	0,634	H	Sig	0,515	S	Sig
	2	*Parmelia glabratula*	0,765	H	Sig	0,130	VL	Sig
	3	*Lepraria incana*	0,386	L	Sig	0,668	H	Sig
	4	*Grafis scripta*	0,627	H	Sig	0,281	L	Sig
	5	*Opegrapha atra*	0,187	VL	Sig	0,236	L	Sig
	6	*Pertusaria amara*	0,291	L	Sig	0,544	S	Sig

Specification:

r = correlation; A = level of correlation; H = Height; S = Suficient; L = Low; VL = Very Low; B = Significant Level; NSig = Not Significant; Sig = Significant

Zone 1 locations are classified as high-traffic areas. *Lichens* type found is only three types. Correlation (r) with the physical properties of the media *Lichens* grow extremely low level of correlation (-) not significant and proportional. Negative correlation indicates that the lower colony Lichens, the lower the Physical Properties of Growing Media (air temperature, air humidity and light intensity of wind speed). Moderate correlations (r) Lichens with ambient air showed a positive correlation with the level of correlation is quite significant and proportional. The positive correlation indicates that the higher colony Lichens, the higher the ambient air in the form of carbon monoxide (CO), nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) and carbon dioxide (CO_2).

Correlation of *Lead (Pb)* Lichenes with traffic density

Lichenes has the ability to absorb lead from the air. The rate of accumulation can lead increases with the density of traffic flow and decreases when more distant from the edge of the highway. According to Dahlan (1989) lead content in plants that are on the edge of the road may reach 50 ppm, but that number will decrease 2-3 ppm at a distance of 150 meters from the highway. Furthermore, to determine the correlation of Pb Lichens with traffic density were calculated using a computerized program SPSS 18 shown in Table 6.

Table 6. Correlation analysis Pb Lichenes with traffic density

No	Species name	Location 1			Location 2			Location 3		
		R	**A**	**B**	**R**	**A**	**B**	**R**	**A**	**B**
1	*Grafis scripta*	-	-	-	0,951	VH	Sig	0.999	VH	Sig
2	*Lepraria sp.*	-	-	-	0,778	H	Sig	-	-	-
3	*Lepraria incana*	0,537	S	Sig	0,937	VH	Sig	0,853	VH	Sig
4	*Opegrapha atra*	-	-	-	0,955	VH	Sig	0,509	VH	Sig
5	*Parmelia sp.*	-	-	-	0,869	VH	Sig	0,918	VH	Sig
6	*Parmelia glabratula*	-	-	-	0,984	VH	Sig	0,672	VH	Sig
7	*Parmelia saxatilis*	-0,009	VL	NSig	0.958	VH	Sig	-	-	-
8	*Pertusaria amara*	0,945	VH	Sig	0,955	VH	Sig	0,891	VH	Sig

Description: Location 1. Jl. Yos Sudarso, Medan; Location 2. Jl .. Sudirman, Medan; Location 3. Jl. Cik Ditiro, Field. r = Correlation. A = Level of Correlation (VH = Very High, H = Hight; S = sufficient; L = Low; VL = Very Low). B = Significant Level (NSig = Not Significant S = Significant)

The results of the analysis of the content of *Pb* in 3 different locations very real with *Pb* at two other locations. This is due to the location 3 has traffic density is much lower than the other sites. 3 locations located in schools and offices that are low traffic access. Value content of *Pb* in *Lichen Talus* derived from location 1 and location 2 does not have a significant difference, caused ecological almost simultaneously.

Location 1 *Pb Lichens* which correlation with traffic density correlation *Parmelia saxatilis* is very low and not significant. Negative correlation (-) indicates that the correlation in the opposite direction or inversely proportional, which means if the volume of traffic is high then the less extensive *Talus Lichens* and vice versa. Type Pertusaria amara has a very high level and significant correlation compared with other types.

Being on Location 2 and Location 3 Pb Lichens correlation with density has a positive and significant correlation with the degree of correlation is very high and directly proportional. Jamhari research results (2010); Walterbeek, et.al (2003) the morphology and physiology of Lichens are considered relevant to metal accumulation. Lichens show tolerance to metals. Determination of metal concentrations commonly used approach by utilizing bioindikasi Lichens metal pollution (Garty, 2001). Some common metals measured include black lead (Pb), Cadmium (Cd), Chromium (Cr), Zinc (Zn) and copper (Cu).

4. Conclusion

There are 8 types of *Lichenes* the mahogany tree stands in the city of Medan, which the highest types number is in location 2, as many as 8 species, and the lowest is at location 1, as much as 3 types. *Lichens* found are divided in 2 type of talus, namely *Crustose* and *Foliose* type, medium type, and the *squamulose fructicose Liken* type *Lepraria unidentified sp*., and *Pamelia sp* are not found.

Pb accumulated in the *Talus Pertusaria amara* ranged from 5.23 to 15.07 ppm. Being on *Lepraria incana* ranged 1.19 to 4.88 ppm. *Pertusaria amara* is much larger than the *Lepralia incana*, which have potential as bio-indicators of resistance is found in a variety of areas with different levels of air pollution. *Pertusaria amara* and *Lepraria incana Lichen* is belonging to the tolerant cosmopolitan type, because it can be found throughout the observation location types which are classified as the most resistant to the percentage of attendance, either clean air or polluted air. Type of *Pertusaria amara* has a very high level and a significant correlation compared with other types. The correlation of *Pb* accumulated in *Parmelia saxatilis talus* with correlation traffic density is very low and not significantly negative. It shows that the correlation in the opposite direction reversed or which

means if the traffic volume is high, then the less extensive *Talus Lichens* and vice versa. Pb Lichens with traffic density has a very high degree of correlation with the very real significance. Pb accumulation of high power, there is the type of *Graphics scripta* (r = 0.999), which has a highest degree of correlation than other types.

Ecological characteristics (chemical physics environmental factors) of each study site when compared with conditions during the last five years (2009-2013) are relatively constant, while the ambient air with parameters (CO), (NO_2), (SO_2) and (CO_2) is still much to be below the threshold applicable air quality standards in Indonesia. Lichenes Correlation with Physical Properties of Growing Media is significant, except at the location of Jl. KL Yos Sudarso Medan, a very low level of correlation (negative) was not significant and proportional. While Correlation with *Ambient Air Lichenes* of all of locations is positive correlation significantly and proportionally. The higher colony *Lichenes* is the higher the ambient air.

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