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Potency of *Jatropha integerrima* Jacq., *Hibiscus rosa-sinensis* L. and *Ruellia tweediana* as Absorbants of Lead (Pb) in Air

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ABSTRACT

Air pollution is an atmospheric condition with high concentrations of toxic metals that exceed normal limits and are harmful to humans, animals or plants. *Jatropha integerrima* Jacq., *Hibiscus rosa-sinensis* L., and *Ruellia tweediana* have the potential to absorb (Pb) in the air. The aim of the study to analyze the levels of (Pb), chlorophyll, and the relationship between levels of (Pb) and chlorophyll in the three plant species at different locations. Samples were obtained from three locations with different traffic volumes Mayjend Yono Soewoyo street (100346.50 units/day), Dr. Soetomo street (58997.80 units/day), and Polisi Istimewa street (25692.50 units/day) Surabaya. Each sample was taken as many as 15 leaves at the third node. Leaf (Pb) measurements were carried out by dry ashing method using *Atomic Absorption Spectrophotometry* (AAS) and chlorophyll content was measured extraction method followed analysis by Spectrophotometer. Data levels (Pb) and chlorophyll were analyzed using two-way ANOVA followed by Duncan's test and correlation test with SPSS Statistics 26. The results showed that (1)Pb levels in the three plants from high to low *J. integerrima* (0.152±0.032 mg.L^{-1}); *H. rosa-sinensis* (0.042±0.008 mg.L^{-1}); and *R. tweediana* (0.007±0.006 mg.L^{-1}), (2)chlorophyll content of plant leaves from high to low *R. tweediana* (33.891±0.510 mg.L^{-1}); *H. rosa-sinensis* (28.499±0.32 mg.L^{-1}), and *J. integerrima* (10.597±1.697 mg.L^{-1}) high volume of vehicles followed by increasing levels of (Pb) and decreasing levels of chlorophyll, namely at Mayjend Yono Soewoyo street, Dr. Soetomo street, and Polisi Istimewa street, (3)there is a correlation between levels (Pb) and leaf chlorophyll content (0.524>0.381). Can be concluded that *J. integerrima*, *H. rosa-sinensis*, and *R. tweediana* have the potential as absorbents (Pb) in the air.

INTRODUCTION

The second largest city in Indonesia is Surabaya with a dense population. The population of Surabaya City in 2020 is 2.971.300 (Surabaya City Central Statistics Agency 2021). Population growth causes the number of motorized vehicles that support community activities to increase (Arifiyananta 2015). Surabaya is included in the top five most congested cities in the world with a congestion value of 29.880/year (Irawan 2017). Traffic density in Surabaya on several roads is not the same.

Efforts to reduce pollutants in the air due to motor vehicle emissions are created parks on the edge or in the middle of the road. Plants can absorb lead (Pb) in the air through a passive absorption mechanism (Fascavitri et al. 2018, Gunarno 2014). Muzayanah et al. (2016) stated that lead (Pb) is a type of PM_{10} pollutant which has a particle size of less than 10 μm. Lead (Pb) is particulate measuring ±2m and leaf stomata measuring 10 μmx27μm so that (Pb) can easily enter through leaf stomata (Sari et al. 2016). Heavy metals absorbed by leaves can affect the work of enzymes involved in the dark reactions of the photosynthesis process (Harianto 2018).

Lead (Pb) causes plants to have chlorosis, decreases chlorophyll biosynthesis processes, and damages plant cell walls. The decrease in chlorophyll is followed by an increase in (Pb) levels, this destroys chloroplasts. The average level (Pb) of several plant species is between 0.1-10 ppm with a toxicity limit of lead (Pb) in higher plants at 100 ppm (Inayah et al. 2010).

Leaf morphological characteristics such as smooth leaves, rough leaf surface, scaly, jagged edges, needle-like leaves, and sticky surfaces affect the ability to absorb (Pb) in the air (Santoso 2013). Plants that have hairy leaves and rough surfaces absorb pollutants more optimally than smooth leaves and smooth surfaces (Rachmadiarti et al. 2019). The potential of plants to absorb pollutants in the air is also influenced by several environmental factors such as temperature, water content, light intensity, humidity, and wind speed.

J.integerrima plants have a shrub habit and elongated leaf morphology with tapered ends; *H.rosa-sinensis* plant has a shrub habitus and ovate leaf morphology; and *R.tweediana* have a herbaceous habitus and morphology of leaves is single, oppositely crossed, ends are rounded, the base is pointed, edges are serrated, the leaf is pinnate, and leaves are green. Based on previous research, plant leaves can absorb (Pb) in the air. This is evidenced when levels of (Pb) are high, and the chlorophyll content of leaves is low. From the results of previous research, further research is needed to determine the ability of the leaves of *J.integerrima*, *H.rosa-sinensis*, and *R.tweediana* plants to absorb (Pb) and their effect on chlorophyll content.

MATERIALS AND METHODS

Sample Collection

Sampling was carried out from polluted and unpolluted locations. The location is unpolluted on Bukit Darmo Golf and three roads in Surabaya City with an average daily volume of high, medium, and low-density levels (Fig. 1). Data on the average volume of vehicles passing at different densities were obtained from the Surabaya City Transportation Service 2020. The average daily volume of vehicles passing on Mayjend Yono Soewoyo street (100.346.50 units/day) high vehicle density; Dr.Soetomo Street (58997.80 units/day) medium vehicle density; and Polisi Istimewa street (25.692.50 units/day) low vehicle density category. Sampling leaves were carried out at each location, repetition was carried out 3 times by plotting at 09.00 WIB.

At each sampling location, physical and chemical environmental factors were measured before a sample was taken, including soil temperature, air temperature, air humidity, soil moisture, soil pH, and light intensity. Samples were taken from as many as 15 leaves from the third node counted from the tip of each plant *J. integerrima*, *H.rosa-sinensis*, and *R.tweediana*. Each sample obtained was put in plastic and given a label. Leaf samples obtained were analyzed for lead (Pb) levels, chlorophyll, and leaf surface area measurements. Analysis test for lead (Pb) levels in samples was carried out at Chemical Physics Laboratory, Chemistry Department, FMIPA UNESA. Tests for the content of chlorophyll a, b, and total and surface area of leaf samples were carried out at Physiology Laboratory, Department of Biology, FMIPA UNESA.

Analysis Leaf Surface Area

Measurement of leaf surface area using *leaf meter* ADC AM350 by placing the sample on the meter area. Measurement of leaf surface area by pressing the scanner button on the tool and moving it from base to tip. The scanner button is pressed again when the measurement has been made, the results can be viewed on the monitor and recorded.

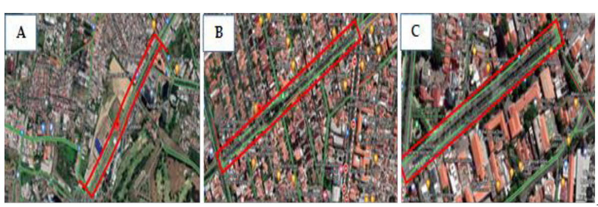
Analysis of Chlorophyll Content

Testing the leaf chlorophyll content of each sample begins with calibration The Mapada V-1100D spectrophotometer uses 95% alcohol. The sample at each location was weighed as much as 1g, cut into small pieces, and crushed with a mortar pestle. Samples that have been finely added 100mL 95% alcohol and filtered through filter paper. The filtrate was then tested for chlorophyll content with wavelengths of 649 nm and 665 nm using the Mapada V-1100D Spectrophotometer. The value of chlorophyll content that appears on the screen is recorded and the chlorophyll content a, b, and the total is calculated using the Wintermasn and de Mots formula as follows (Rahayu et al. 2014):

$$\text{Chlorophyll a} = 13.7\text{xOD } 665–5.76\text{OD } 649\ (\text{mg.L}^{-1})$$

$$\text{Chlorophyll b} = 25.8\text{xOD } 649–7.7\text{OD } 665\ (\text{mg.L}^{-1})$$

$$\text{Total chlorophyll} = 20.0\text{xOD } 649+6.1\text{OD } 665\ (\text{mg.L}^{-1})$$



Note Notation A: Sampling on Mayjend Yono Soewoyo street, Notation B: Sampling on Dr. Soetomo street, Notation C: Sampling in Polisi Istimewa street.

Fig. 1: Sampling Locations (Google Maps, 2021)

Analysis of Pb Content

Sample preparation: The analysis of accumulation levels (Pb) in the leaves was started by conducting sample preparation using the dry destruction method. *J.integerrima*; *H.rosa-sinensis*, and *R.tweediana* plant leaves were weighed as much as 2.5 g in a porcelain dish and roasted at $800^{o}C$ for 3 h. The samples that have been kilned are put into a glass beaker, 1mL concentrated HNO_3 solution is added, and 10 mL aqua demin is added. The sample was stirred until dissolved and filtered, then analyzed by AAS (*Atomic Absorption Spectrophotometry*) PERKIN ELMER Analyst 100.

Production standard metal solutions: Preparation of standard solutions is done by making a standard solution of lead (Pb) as much as 100 ppm. Standard lead solution (Pb) was made from 100 ppm lead (Pb) mother liquor, then 10 mL was taken using a dropper and put into a 100 mL volumetric flask. The solution that has been put into a measuring flask is then diluted to the tera mark and homogenized. Metalworking solution (Pb) 10 ppm was prepared from standard solution (Pb) 100 ppm.

Production calibration curves: The calibration curve was made by making a standard solution (Pb). The standard solution was prepared by diluting solution (Pb) of 10 ppm to obtain a concentration between 0-3ppm. The standard solution then measured its absorption value using AAS PERKIN ELMER Analyst 100 with a hollow cathode (Pb) lamp.

Sample measurement: Measurement of leaf samples of each plant was carried out using the SNI method number 06-698945 of 2005 concerning Testing for Levels (Pb). Calculation of levels (Pb) contained in each sample of plant leaves *J.integerrima*; *H.rosa-sinensis* and *R.tweediana* use the following formula:

$$Cy' = \left(Cy \times \frac{v}{w}\right) x\ 1000$$

Description:

Cy' = Pb levels absorbed in leaves ($\mu g.g^{-1}$)

Cy = Measurable Pb levels in AAS ($mg.L^{-1}$)

V = Volume of diluent solution (L)

W = Leaf biomass in the form of leaf dry weight (g)

1000 = Convert mg to $\mu g.g^{-1}$

Data Analysis

Observational data in form of levels (Pb) and leaf chlorophyll were analyzed using statistical tests *Two Way* ANOVA with SPSS statistic 26 was conducted to see the effect of sampling location, plant species and interaction between the observation location and plant species on content (Pb). The analysis test was continued with Duncan's Test to see which plants had the best potential to absorb lead (Pb) in the air. Leaf surface area data and environmental physicochemical factors were analyzed quantitatively descriptively. A correlation test using SPSS Statistics was carried out to see the relationship between (Pb) in the leaves of each plant and chlorophyll.

RESULTS

Based on the results of testing the levels (Pb) in the leaves of *J.integerrima*; *H.rosa-sinensis* and *R.tweediana* in three different locations including Mayjend Yono Soewoyo street, Dr. Soetomo street, and Polisi Istimewa street showed different levels of (Pb). The highest (Pb) content was found in *J.integerrima* 0.152±0.032 $mg.L^{-1}$ found on Mayjend Yono Soewoyo. The lowest leaf (Pb) levels were found in *R.tweediana* 0.007±0.006 $mg.L^{-1}$ was found on Polisi Istimewa. The results from Duncan's test showed that there were differences in leaf (Pb) levels of each plant at each location (Table 1).

Testing of leaf chlorophyll content in *J.integerrima* plants; *H.rosa-sinensis*, and *R.tweediana* at three different locations including Mayjend Yono Soewoyo street, Dr. Soetomo street, and Polisi Istimewa street showed different results. The highest leaf chlorophyll content was found in *R.tweediana* 33.891±0.510 $mg.L^{-1}$. The lowest leaf chlorophyll content was found in *J.integerrima*, which was 10.597±1.697 $mg.L^{-1}$. The results of Duncan's test showed that there were differences in leaf chlorophyll levels in each plant at each location (Table 2).

Measurements of the leaf surface area of each plant at each sampling location showed different values. The results of the measurement of the highest leaf surface area were found in *R.tweediana* on Mayjend Yono Soewoyo (20.358±0.490 cm^2). The lowest average leaf surface area was found in *J.integerrima* plants with a value of (15.612±1.790 cm^2) which was located on Polisi Istimewa street (Table 3).

Table 1: Metal (Pb) Content of Leaves *J.integerrima; H.rosa-sinensis*, and *R.tweediana.*

Plant Type	Average Leaf (Pb) Content at Each Location [$mg.L^{-1}$]		
	1	2	3
J.integerrima	0.152± 0.032bB	0.101± 0.031bAB	0.008± 0.001bA
H.rosa-sinensis	0.042± 0.008abB	0.014± 0.010abAB	0.125± 0.018abA
R.tweediana	0.061± 0.015aB	0.101± 0.070aAB	0.007± 0.006aA

Notes: Notation: Numbers followed by different notations in rows and columns show significantly different results based on Duncan's Test with a test level of 0.05; 1= Mayjend Yono Soewoyo street (3 repetition points); 2= Dr. Soetomo street (3 repetition points); and 3= Polisi Istimewa Street (3 repetition points).

Physical and chemical environmental factors of each plant *J.integerrima; H.rosa-sinensis*, and *R.tweediana* at Mayjend Yono Soewoyo street, Dr. Soetomo street, and Polisi Istimewa street are not the same. Soil pH values range from 7-8; soil moisture 1-8(%Rh); soil temperature 26-29(^{o}C); air humidity 32-60(%); air temperature 31-40(^{o}C); and light intensity 3652-25044(Lux) (Table 4).

High levels of Pb in the plant, resulting a decrease in leaf chlorophyll content. The highest Pb levels in *J.integerrima* on Mayjend Yono Soewoyo street (0.152±0.032 mg.L^{-1}) had the lowest chlorophyll content (10.597±1.697 mg.L^{-1}), while the lowest Pb levels were found in *R.tweediana* plants on Polisi Istimewa street (0.007±0.006 mg.L^{-1}) had chlorophyll content (20.276±0.478 mg.L^{-1}) (Table 5).

Plant surface types *J.integerrima*; *H.rosa-sinensis*, and *R.tweediana* are not the same. Different leaf types and leaf characteristics affect the absorbing metal (Pb) in the air (Table 6).

Table 2: Chlorophyll Content of Plant Leaves *J.integerrima; H.rosa-sinensis*, and *R.tweediana.*

Plant Type	Average Leaf Chlorophyll Levels at Each Location [mg.L^{-1}]		
	1	2	3
J.integerrima	10.597±1.697aC	12.236±1.333aB	21.540±1.427aA
H.rosa-sinensis	28.499±0.321bC	24.262±0.456bB	14.869±0.975bA
R.tweediana	33.891±0.510cC	23.561±0.039cB	20.276±0.478cA

Notes: Notation: Numbers followed by different notations in rows and columns show significantly different results based on Duncan's Test with a test level of 0.05; 1= Mayjend Yono Soewoyo street (3 repetition points); 2= Dr. Soetomo street (3 repetition points); and 3= Polisi Istimewa street (3 repetition points).

Table 3: Leaf Surface Area of *J.integerrima; H.rosa-sinensis*, and *R.tweediana.*

Plant Type	Average Leaf Surface Area at Each Location (cm^{2})		
	1	2	3
J. integerrima	16.526±0.589	16.319±0.442	15.612±1.790
H. rosa-sinensis	17.778±0.558	17.630±0.726	17.732±0.140
R. tweediana	20.358±0.490	19.640±0.180	20.111±0.366

Notes: 1= Mayjend Yono Soewoyo street (3 repetition points); 2= Dr. Soetomo street (3 repetition points); and 3= Polisi Istimewa street (3 repetition points).

Table 4: Environmental Chemical Physics Factors

Plant Type	Average Soil pH			Average Soil Moisture [%Rh]		
	1	2	3	1	2	3
J. integerrima	7.33± 0.57	8.00± 0.00	7.00± 0.00	6.00±2.00	2.66± 1.15	1.00± 0.00
H. rosa-sinensis	7,00± 0.00	8.00± 0.00	7.66± 0.57	8.33±0.57	4.66± 0.57	1.00±0.00
R. tweediana	7.11±3.333	8.00± 0.00	7.55± 0.52	8.33±1.15	1.66± 0.57	1.00±0.00
Plant Type	Average Air Humidity (%)			Average Air Temperature (oC)		
	1	2	3	1	2	3
J. integerrima	32.66±1.15	58.33±0.57	51.66±0.57	36.33±0.57	33.66±0.57	37.33±0.57
H. rosa-sinensis	60.00±1.00	60.00±0.00	50.66±0.57	31.00± 2.00	33.00±0.00	35.00±0.00
R. tweediana	50.11±13.14	60.00±1.50	50.77±0.83	40.33± 11.84	40.00±11.26	37.66±0.57
Plant Type	Average Soil Temperature (^{o}C)			Average Light Intensity (Lux)		
	1	2	3	1	2	3
J. integerrima	26.66±0.57	27.00±0.00	29.33±0.57	10847.00±2555.36	3652.66±1177.06	6458.33±1189.94
H. rosa-sinensis	28.00±0.00	26.66±0.57	28,00±1,00	23200.00±769.08	7480.00±423.42	7689.00±1468.55
R. tweediana	28.3±0.57	27.66±0.57	29.33±2.08	25044.33±7289.70	15136.00±3270.56	15098.66±3678.690

Notes: 1= Mayjend Yono Soewoyo street (3 repetition points); 2= Dr. Soetomo street (3 repetition points); and 3 = Polisi Istimewa street (3 repetition points).

Tests on Pb levels, leaf chlorophyll content, leaf surface area, and physical and chemical factors in the unpolluted environment at Bukit Darmo Golf Surabaya. *J.integerrima* plants showed the highest levels of Pb (0.025 $mg.L^{-1}$); followed by *H.rosa-sinensis* (0.012 $mg.L^{-1}$), and *R.tweediana* (0.008 $mg.L^{-1}$). The highest leaf chlorophyll content was found in *R.tweediana* (13.309 $mg.L^{-1}$), followed by *H.rosa-sinensis* (11.793 $mg.L^{-1}$), and *J.integerrima* (11.679 $mg.L^{-1}$). The highest leaf surface area was found in *R.tweediana* (20.69 cm^2), followed by *H.rosa-sinensis* (16.75 cm^2), and *J.integerrima* (15.66 cm^2). Measurement of environmental physicochemical factors at Bukit Darmo Golf, Surabaya showed a different range of results for each plant. The soil pH value of the three plants is 7; soil moisture 1-1.89 (%Rh); Soil temperature 27-29(^oC); humidity 70.22-70.89 (%), air temperature 29-30 (^oC), and light intensity 5267.8-11465.1 (Lux) (Table 7).

DISCUSSION

Every year number of motorized vehicles continues to increase. Population growth causes the number of motorized vehicles as community activity increases (Arifiyananta 2015). Air pollution is a condition where there is a mixture of several harmful elements in the atmosphere that cause damage and reduce environmental quality (Abidin & Hasibuan 2019). The decline in environmental quality due to air pollution can harm living things (Fransiska 2016).

Lead (Pb) is one of the most common pollutants produced by motorized vehicles. Fossil-fueled motor vehicles are known to affect air quality as much as 79-97% of concentration (Pb) (Ruslinda et al. 2016). Metal (Pb) is dangerous metal; has bluish-gray color; with theatomic number 82; molecular weight of 207.2; density of 11.34 $g.cm^{-3}$; and boiling point of 621.43^{o}F (Kumar et al. 2020).

Plants can absorb pollutants (Pb) in the air and adapt in different ways. Efforts that are currently being developed in overcoming heavy metals in the air are using green plants. Phytoremediation is an air pollution control that is carried

Table 5: Relationship of Levels (Pb) and Leaf Chlorophyll Levels in Plants *Jatropha integerrima* Jacq., *Hibiscus rosa-sinensis* L., and *Ruellia tweediana.*

Sampling Location	Plant Type					
	J.integerrima		*H.rosa-sinensis*		*R.tweediana*	
	1	2	1	2	1	2
Mayjend Yono Soewoyo street	0.152±0.032	10.597±1.697	0.042±0.008	28.499±0.321	0.061±0.015	33.891±0.510
Dr. Soetomo street	0.101±0.031	12.236±1.333	0.014±0.010	24.262±0.456	0.101±0.070	23.561±0.039
Polisi Istimewa street	0.008±0.001	21.540±1.427	0.125±0.018	14.869±0.975	0.007±0.006	20.276±0.478

Notes: 1= Leaf Pb Content (mg/L); Leaf Chlorophyll Content (mg/L)

Table 6: Leaf surface type *J. integerrima*; *H. rosa-sinensis*, and *R. tweediana*.

Plant Type	Leaf Surface Type	Characteristic features	Picture
J. integerrima	Hispidus (Rough Trichomed Leaf Surface)	Single leaf, oval shape, finger bone, scattered.	
H. rosa-sinensis	Laevis (Slippery Leaf Surface)	The leaf blade is oval, the base is tapered, the edges are jagged, and the bones are fingered.	
R. tweediana	Villosus (Smooth and Tight Trichomed Leaf Surface)	Single leaf, crossed opposite, sole-shaped, rounded leaf tip, tapered leaf base, serrated leaf edge, and pinnate leaf spines.	

Table 7: Test results for metal content (Pb), leaf chlorophyll content, leaf surface area, and environmental physicochemical factors in *J. integerrima; H. rosa-sinensis*, and *R. tweediana* at Bukit Darmo Golf, Surabaya.

Plant Type	Leaf Pb [$mg.L^{-1}$]	Leaf Chlorophyll [$mg.L^{-1}$]	Leaf Surface Area [cm^2]
J. integerrima	0.025	11.679	15.66
H. rosa-sinensis	0.012	11.793	16.75
R. tweediana	0.008	13.309	20.69
Plant Type	Soil Moisture (%Rh)	Soil Temperature (^oC)	Humidity (%)
J. integerrima	1.00	27	70.22
H. rosa-sinensis	1.89	28	70.89
R. tweediana	1.00	28	70.56
Plant Type	Soil pH	Air Temperature (^oC)	Light Intensity (Lux)
J. integerrima	7	29	5267.8
H. rosa-sinensis	7	30	5856.0
R. tweediana	7	29	11465.1

out using cost-effective, energy-saving, and environmentally friendly technology (Rachmadiarti et al. 2021).

The highest (Pb) content was found in the *J.integerrima* plant obtained at Mayjend Yono Soewoyo (0.188 $mg.L^{-1}$). The lowest levels of (Pb) in the leaf were found in *R.tweediana* obtained at Polisi Istimewa (0.002 $mg.L^{-1}$). The level (Pb) at Bukit Darmo Golf from high to low is *J.integerrima* (0.025 $mg.L^{-1}$); *H.rosa-sinensis* (0.012 $mg.L^{-1}$), and *R.tweediana* (0.008 $mg.L^{-1}$). Muzayanah et al. (2016) stated that metal (Pb) of the PM_{10} group has particulates measuring ±2μm and leaf stomata 10μmx27μm so that (Pb) easily enters through leaf stomata (Sari et al. 2016). The test results show if *J.integerrima* potential to absorb (Pb) in the air.

The ability of *J.integerrima* to absorb (Pb) in the air is influenced by leaf morphology. *J.integerrima* leaves have an oval egg with 1-2 lobes in the lower half of the strands; base rounded, flat, or heart; and tapered tips (Silalahi & Mustaqim 2021). *J.integerrima* is a shrub habitus plant with a height of 3m; has a single green leaf, oval in shape, leaf bones are fingered, the tip is tapered, and has a very thick trichome. Plant *J.integerrima is* considered the most effective in absorbing (Pb) because it has leaf morphology that supports and lines with previous studies. The results of Rachmadiarti's et al. (2019) that plants with thyme leaves and rough surfaces absorb pollutants more optimally than plants with smooth leaves and smooth surfaces.

Testing of total leaf chlorophyll content showed that the highest was found in *R.tweediana* (34,202 $mg.L^{-1}$) obtained from Mayjend Yono Soewoyo. The lowest chlorophyll is found in *J.integerrima* (9.271 $mg.L^{-1}$) at Mayjend Yono Soewoyo. Testing of chlorophyll content at Bukit Darmo Golf showed that the highest level was found in *R.tweediana* (13.309 $mg.L^{-1}$) and the lowest was found in *J.integerrima* (11.679 $mg.L^{-1}$). *R.tweediana* is a herbaceous habitus plant with a height of 1-1.5m; tricot rod; single leaf, opposite solet shape, rounded tip, pointed base, toothed edge, and pinnate leaf bone. *R.tweediana* potential as metal (Pb) absorbent in the air. These results are in line with research by Fathia et al. (2015) plants that have the potential to absorb pollutants can accumulate lead in large quantities without causing a decrease in leaf chlorophyll and causing poisoning to plants. High levels of (Pb) in leaf tissue *J.integerrima* causes a decrease in leaf chlorophyll content. The test results are in line with Sari et al. (2016) and Rachmadiarti et al. (2019) who state that the increase in leaf chlorophyll levels is directly proportional to a decrease in pollution by (Pb), so that leaf chlorophyll levels can be used as identification of plant resistance to pollution in the air by (Pb).

Lead Pb in plants can inhibit photosynthesis, disrupt mineral nutrition and water balance, change hormonal status, and affect the structure and membrane permeability of plants (Hadi & Aziz 2015). Heavy metals will inhibit enzymes that play a role in the photosynthesis process of dark reactions (Harianto & Pohan 2018). Metals (Pb) can inhibit the absorption of cations such as Ca, Mg, K, Cu, Zn, and Fe through modification of membrane activity and permeability so that they cannot be absorbed and transported into the plant body is disrupted (chlorosis occurs) (Patra et al. 2011). Physiologically toxicity (Pb) inhibits chlorophyll biosynthesis in leaf chloroplasts.

Measurement of plant leaf surface area shows leaves *R.tweediana*on Mayjend Yono Soewoyo had the highest average rating (20,358 cm^2) and plant leaves *J.integerrima*on Polisi Istimewa shows the lowest average value (15,612 cm^2).

Measurement of the highest leaf surface area at Bukit Darmo Golf was found in *R.tweediana* (20.69 cm^2), *H.rosa-sinensis* (16.75 cm^2), and *J.integerrima* (15.66 cm^2). The results of leaf surface area measurements are in line with research by Irma (2016) which states that levels of (Pb) can result in changes in leaf morphology covering the leaf surface; an arrangement of leaf veins, leaf base; leaf edge; leaf tips; and leaf color so that morphological changes result in a reduction in leaf surface area.

The entry of metal (Pb) in the network is influenced by physical and chemical environmental factors. The results of soil pH measurements showed values from 7-8. Research by Gultom and Lubis (2014) states that the optimal pH for absorbing (Pb) is 4 or in an acidic environment. Although the results of the research conducted showed that the environmental pH conditions were normal and not acidic, it was known that all types of plants were able to absorb pollutants (Pb) in the air.

The results of air humidity showed values between 32-60(%). Air humidity affects the opening of leaf stomata. High humidity values can cause leaf stomata to open wide so that pollutants can be absorbed more optimally. Humid environmental conditions also cause some pollutants in the air to bind water and then settle in plant bodies (Azzari et al. 2020).

Air temperature measurement shows a value of 31-40(^{o}C). The temperature of each environment shows the optimal value. The results of research by Azizah & Rachmadiarti (2018) state that the optimal temperature in the environment is 30^{o}C with a maximum level of 40^{o}C. The optimal temperature in the environment has a positive impact because the leaf stomata will open and (Pb) in the air enters the plant tissue. The high temperature causes the concentration of (Pb) in the air to decrease because the high air temperature causes the concentration of pollutants in the air to become dilute (Winardi 2014).

Another physical and chemical factor that affects the absorption of (Pb) is soil moisture. Measurement of soil moisture shows the number 1-8 (%Rh).The high value of soil moisture results in disruption of the process of transpiration and absorption (Pb) in the air. The results of Dewanti's research (2012) state that high humidity values cause the transpiration rate to slow down due to the presence of water vapor.

The results of the measurement of light intensity ranged from 3652-25044 (Lux). A good light intensity ranges from ±32,000 lux, and a low light intensity value causes the photosynthesis process to not run optimally and the leaf stomata to close (Ibrahim & Hizqiyah 2013). Light intensity is a physical and chemical environmental factor that has influence the absorption of (Pb) in the air. The moderate or full light intensity can affect the growth of a plant (Yuliantika & Sudarti 2021).

CONCLUSION

The results of the research conducted can be concluded that the *J.integerrima*; *H.rosa-sinensis*, and *R.tweediana* have the potential to absorb pollutants (Pb) in the air. The level of (Pb) in the air is influenced by the amount of traffic density on Surabaya. The average levels (Pb) in plant leaves sequentially from high to low starting from *J.integerrima* (0.152±0.032 mg.L^{-1})*; H.rosa-sinensis* (0.042±0.008 mg.L^{-1}), and *R.tweediana* (0.007±0.006 mg.L^{-1}). Levels (Pb) affect leaf chlorophyll levels.The highest chlorophyll content was found in *R.tweediana* (33,891±0.510 mg.L^{-1}.), *H.rosa-sinensis* (28.499±0.32 mg.L^{-1}), and *J.integerrima* (10,597±1,697 mg.L^{-1}). Based on the results of the study, it shows that if the average daily traffic volume is getting denser, it will be followed by high levels of (Pb) in the leaves, namely at Mayjend Yono Soewoyo, Dr. Soetomo, and Polisi Istimewa street. There is a correlation between the levels of (Pb) and chlorophyll (0.524>0.381). From these results, it can be concluded that *J.integerrima*, *H.rosa-sinensis*., and *R.tweediana* have the potential as absorbents (Pb) in the air.

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