The Effectiveness of Anti-Lead Mask Made from Water Hyacinth on Cigarette Industry Employees in Malang City

Meidy Binarrasitha Aisyi[1*]

[1]Universitas Negeri Jember, Indonesia
*Corresponding Author: meidyrasitha@gmail.com

Abstract : This research aims to determine the effectiveness of anti-lead mask from water hyacinth on cigarette industry employees in Malang city. By applying experimental research methods carried out on 82 workers from the 'X' cigarette factory, members of the Association of Cigarette Companies (Gapero) Malang Raya divided into 2 groups (experimental control and group), it is found that the Cigarette Industry Workers are given a mask made of water hyacinth as a filter for a group that is not given special treatment. After 2 months, the blood lead levels of cigarette factory workers are measured again and found that there is an increase in the number of factory workers with tolerable lead levels from the previous 27 people (65.85%) to 38 people (92.68%), or it can be interpreted that only 3 workers (7.32%) have excess blood lead levels in the experimental group.

Keywords: *Mask, Water Hyacinth, Cigarette Industry*.

1. Introduction

The human population on earth is increasing over time. Based on data, the earth's population as of August 2020 is 7.8 billion (Kompas Data, 2020). Humans carry out activities to meet the needs of life called ‘work’. Various business sectors are carried out by humans such as industry, agriculture, fisheries, tourism, services, etc (Kotler, 2009). It encourages the industry development used by humans to meet their needs. The development of the industrial sector, in addition to increasing productivity, often causes negative impacts such as work accidents frequently occurring in production activities. It can be dangerous for humans and also the environment (Sophisticated 2012).

Worker safety plays a very important role in this field. Occupational safety refers to the safety of machines, aircraft, work equipment, materials, processing operations, workplace foundations, environment, and work methods. Personal Protective Equipment (PPE) is designed to protect all or part of the body from potential hazards. Given the high risk of health problems in the workplace, it is necessary to prevent injuries caused by the work environment and human factors (Samur, 2014).

Occupational Health and Safety Law no. 1 Year 1970, specifically Articles 9, 12 and 14, stipulates that workplace management is responsible for providing Personal Protective Equipment (PPE) for workers and employees. The tobacco industry is an industry that has a high risk of exposure to toxic gases. According to data from the Ministry of Industry in 2010, Indonesia has 3,800 tobacco factories, 3,000 of which are located in Central and East Java (Norpacti, 2012). Toxic substances in tobacco include polonium, nitrosamines, formaldehyde, cadmium, arsenic, cyanide, and lead (Norbaya, 2012).

Exposure to lead (Pb) is closely related to its accumulation in tissues and directly or indirectly interferes with physiological processes at the molecular level. Therefore, lead reduces the production of hemoglobin in the blood which can cause other health problems (Axal, 2015). About 80% of lead enters the human body through the respiratory tract and enters the lungs. Inhaled lead will stick to the blood and spread to various parts of the body. More than 90% of lead absorbed into the blood is associated with red blood cells (Sri S, 2007).

According to the preliminary study conducted on Friday, September 18, 2020, Tobacco X conducted a lead test in its tobacco warehouse. The tests show the presence of lead in the air is 0.623 mg/m3. According to the World Health Organization quality standard and KEPMENKES.1405/MENKES/SK/XI/2002 quality standard, 0.5 g/m30 and 1 mg/m3 are suitable for industrial workplaces. Huwaida (2016) examined blood lead (Pb) levels of employees of the Wido Cigarette Company, Kudos Regency, and found that blood lead levels (>10 g/dl) of 26 participants were abnormal and blood lead levels in 20 subjects were normal (<10 g/dl).

In the working environment of cigarette factory, the longer the working period, the accumulation of lead (Pb) exposure contamination in the body continues to increase. Workers in the cigarette industry are required to use PPE to prevent exposure to toxic gases such as lead (Pb) by wearing masks. The masks used by workers are surgical masks. In addition to supporting work, masks are also considered one of the PPE (personal protective equipment) that the community really needs.

Surgical masks have several advantages, including (covid19.go.id) including the effectiveness of 0.1 micron filtration (30 - <95%) and able to prevent the release of small droplets when the user sneezes/coughs. Surgical masks, in addition to having these advantages, also have the disadvantage that they are only disposable. The price of surgical masks on the market will certainly be uneconomical if they have to change masks every day. Therefore, some workers wear surgical masks more than once. As a result, the effectiveness of surgical masks has decreased and is no longer reaches the standard. Some workers even use cloth masks only. The advantage of cloth masks is they can be used more than once by washing them. Meanwhile, the drawback is that the filtration effect of particles that are below 3 microns in size which is only 30-60% (covid19.go.id).

Water hyacinth (Eichornia crassipes) in Malang City is found in several rivers and ponds owned by the community. This plant is considered a weed, thus, it is rarely used. However, the advantage of water hyacinth is it can remove pollutants from water, especially metal waste because it can absorb dissolved and suspended solids from the water. Water hyacinth has the ability to fluoresce and absorb metals due to its small root system and many branches. This is supported by the results of chemical analysis of fresh water hyacinth showed that the total N content was 0.28%, organic matter was 36.59%, C organic was 21.23%, P total was 0.0011 % and K total was 0.016 % (Hernowo in Al-Ayubi, 2007).

The extraordinary results of the Biochemistry Laboratory of Institut Pertanian Bogor prove this ability. Water hyacinth has studied the absorption of iron (Fe) 1999 and lead (Pb) 2000 (Hasim, 2007). The use of water hyacinth in the filter section will reduce the waste of using disposable masks because the masks only need to be replaced with filters in the form of paper made from water hyacinth. If properly managed, the function of water hyacinth (Eichornia crassipes) can be managed as a mask filter that can protect mask users from exposure to heavy metals such as lead (Pb). Therefore, the researcher wants to raise the problem and potential of water hyacinth (Eichornia crassipes) in the thesis entitled 'the effectiveness of anti-lead mask from water hyacinth on cigarette industry employees in Malang city'.

2. Literature Review

2.1 Mask

A mask is a respiratory protective device used to protect people from inhaling toxic substances and toxins in the air. Masks are used to protect people who are not wearing personal protective equipment from particles and aerosols in the air. NIOSH recommends wearing filter masks to prevent particles and aerosols of various sizes and chemical properties that are harmful to the human body (Ishbonar, 2009).

According to the Regulation of the Minister of Population Number 08 Year 2010 concerning Personal Protective Equipment, a mask is one of the recommended personal protective equipment for employees. There are many types of masks, one of which is the air purifier (APR), which uses a filter or box to block contaminants in the air (Harper, 2012). According to Cohen & Birdner (2012) types of masks have the following types:

1. Quarter Mask: A breathing apparatus that covers the face from the top of the nose to the bottom of the mouth.
2. Half Mask: Half mask respirator that covers the nose and mouth from the top of the nose to the bottom of the chin. It is used for various hazards such as dust and smoke, and gases that can harm users.
3. Full Facepiece: Full face respirator that covers the entire head, usually used to filter particles, aerosols, and gases that irritate the eyes (Enviromental Health & Safety, 2015).

Picture 1: N95 Respirator

Picture 2: Dust Mask

Picture 3: Half face

Picture 4: Full Face

2.2 Lead (Pb)

Lead is known as plumbum (Pb) in scientific language. Lead is a metal with four isotopic forms, blue-gray, or silver, with a melting point of 327.5 °C in the atmosphere and a boiling point of 1740 °C (Josnita, 2012). Saralyan (1994) and Ballar

(1994) in Amalia (2016) vaporize lead at a temperature of 550–600°C and react with oxygen in the air to form lead oxide (Sarian, 1994; Ballar, 2004). Lead is confirmed to be in group IVA heavy metal on the periodic table of chemical elements. Lead has an atomic number of 82 and an atomic weight of 207.2, solid at room temperature, and weighs of 11.4 l. Lead rarely exists in the free state but exists as a compound with other molecules such as PbBr2 and PbCl2 (Gusnita, 2012).

According to Darmono in Raharjo (2001), lead is persistent, toxic, and can accumulate in the food chain. The lead absorption in the body is very slow, thus, it accumulates and gradually becomes a source of poisoning. This type of lead poisoning can cause increased lead levels in the aorta, liver, kidneys, pancreas, lungs, bones, spleen, testicles, heart, and brain (Raharjo, 2018). Lead Metabolism in a body includes in the following.

1. Absorption

   Lead (Pb) enters the human body through the digestive tract, respiratory tract, and skin. The absorption of lead through respiration is affected by three processes such as cleansing, mucosal cleansing, and alveolar filtration.
2. Distribution

   Lead absorbed from the respiratory tract, digestive tract, or skin will be transported through the blood to other body organs.
3. Excretion

   The process of lead excretion can be carried out in several ways, which are through the gastrointestinal tract and kidneys.

   In addition, the process of entering lead into the body through various pathways, including:

1. through the respiratory system,
2. through food and drink, and
3. penetration of the skin layer.

Long-term lead exposure can affect the function of various organ systems. The first effect of chronic lead poisoning before reaching the target organs is the destruction of heme biosynthesis. If not treated immediately, it can affect other organs. Although the amount of lead absorbed by the human body is very small, lead is still dangerous because it is harmful to the body (Palar, 2004).

2.3 Water Hyacinth (Eichhornia crassipes)

Water hyacinth (Eichhornia crassipes) is a floating plant that sometimes takes root underground. According to Nunung (2008), due to the presence of vacuoles and substances called plant aglycones in the cell structure, the extracted water hyacinth is able to absorb heavy metal particles. Water hyacinth can absorb and dissolve toxic metals such as lead (Pb) (0.176 mg/g), mercury (0.15 mg/g), cadmium and pesticides within 14 days (Nunung et al., 2008). Water hyacinth has fiber characteristics seen in Table 2.2.

Table 2.2. Characteristics of Water Hyacinth Plant Fiber

Characteristics	Value
Density (g/cm3)	0.25
Whiteness (%)	22.2
Fineness (μ)	35
Tensile Strength (Mpa)	18-33

Source: Gani et al (2002)

According to Zerudo et al. (2009), water hyacinth leaves contain 34.6% fiberglass, based on furnace dry weight, average length of 1.53 mm, thin walls, and low content of lignin, cholesterol, and pentose. But it contains little silicon, and the extract is slightly soluble in ethanol and benzene, but has good solubility in 1% sodium hydroxide. The nutritional content of 100 grams of water hyacinth can be seen in Table 2.3 below.

Tabel 2.3. Nutritional Content of Water Hyacinth

Nutritional Content	Value
Energy	18 kcal
Protein	1 gr
Fat	0,2 gr
Carbohydrate	3,8 gr
Calcium	80 mg
Phosphor	45 mg
Iron	4 mg

Vitamin A	1000 IU
Vitamin B1	0,08 mg
Vitamin C	50 mg

Source: Ahmed (2012)

Some researchers report that water hyacinth can be used to absorb pollutants in water and reduce the burden of environmental pollution. According to observations, water hyacinth can absorb 1.35 mg/g cadmium, mercury and nickel within 24 hours; if the metal is not mixed with 1.77 mg/g and 1.16 mg/g, if the mineral is mixed with other minerals, Cd will absorb 1.23 mg/g G and 1.88 mg/g and 0.35 respectively mg Ni./G.air (Puspitasari R, 2010).

The chemical composition of water hyacinth depends on the nutrient content in which it grows, and the absorption properties of the plant. Chemical components in water hyacinth

1. Cellulose
   Cellulose is a linear glucose polymer linked by 1,4-glucosidic bond. The linear structure makes crystalline cellulose insoluble. Cellulose is not easily broken down by chemical or mechanical means.
2. Hemicellulose
   Hemicellulose is the main component of non-cellulose polysaccharides found in fiber, with a molecular weight of 4,000 to 15,000, and classified as an organic compound (Soenardi, 1976). Hemicellulose particles are easily absorbed by water. In addition, because hemicellulose particles are plastic and have a wider surface for interaction between molecules, they increase the bonding between fibers in the paper industry.
3. Lignin
   Lignin is a complex molecule consisting of phenyl-propane units linked in a three-dimensional structure. Lignin is the most powerful substance in biomass. Lignin is highly resistant to biological, enzymatic and chemical degradation. Since lignin has a relatively high carbon content compared to cellulose and hemicellulose, lignin has a higher energy content (Unknown, 2008).

2.4 Occupational Health and Safety

According to Vidodo (2015), occupational health and safety (K3) is a field related to the health, safety, and well-being of people who work in organizations and project sites. According to Rivai and Sagala (2013), occupational health and safety refers to the physical and psychological conditions of employees due to the work environment provided by the company.

In accordance with Article 3 of Law Number 1 Year 1970, Chapter 3 concerning Occupational Safety regulates the following safety requirements.

1. Prevent and reduce injuries.
2. Fire prevention, disaster mitigation and fire fighting.
3. Explosion proof and reduce risk.
4. Provide opportunities and means for self-rescue in the event of fire and other hazardous events.
5. Emergency assistance.
6. Provide workers with personal protective equipment.
7. Prevent and control temperature, humidity, dust, smoke, steam, gas, wind, weather, light or radiation, noise and vibration.
8. Prevent and control work-related physical and mental illnesses, poisoning, infections and infections.
9. Get sufficient information.
10. Maintain good humidity and temperature.
11. Provide a suitable air purifier.
12. Cleanliness, Cleanliness and Order.
13. Achieve harmony between workforce, equipment, environment, work methods and procedures.
14. Safe and comfortable transportation of people, animals, plants and goods.
15. Protect and maintain all types of buildings.

According to Article III, Chapter 3, Article 1 of the 1970 Law, Malang's tobacco industry is subject to occupational safety and health, especially in factories that are members of the Gapero (Tobacco Union). In industry, the Occupational Health and Safety Committee is responsible for overseeing, coordinating and supervising occupational health and safety operations in the industrial environment, and for assigning and assigning powers and responsibilities. The OSH Committee is formed in the factory and is appointed directly by the plant manager based on the recommendation from the OHS management, taking into account the performance of each OSH committee and then reflected in the results of the relevant factory regulations.

3. Method

This research is an experimental research with a true-experiment-design approach. In this study, the researchers chose the pre-test-post-test control group design with the aim of knowing the effectiveness of using an anti-lead mask made of water hyacinth on cigarette industry workers in Malang City. This study Is conducted on 82 workers from the 'X' cigarette factory who are members of the Association of Cigarette Companies (Gapero) Malang Raya with the criteria determined by the researcher. All respondents are divided into two groups, the control and experimental group. Both groups are given the same pre-test in the form of measuring blood lead levels through laboratory tests. Then, the experimental group is given treatment in the form of using an anti-lead mask made of water hyacinth for 2 months, while the control group is not given any treatment. After being treated, the lead levels in the blood of the two groups will be measured again as a final test (post-test).

4. Results

4.1 Lead Level Test Results before Treatment

The blood lead level test was carried out in the experimental and control groups before being given treatment by taking a sample of the respondent's blood as much as 50 L which was inserted in a capillary tube and reagent tube and then dripped on the LeadCareTM electrode, then the following results are obtained.

Table 4.1. Test Result of Lead Levels in the Blood of the Experimental Group before Treatment

Respondent	Lead Level (Mg Pb/100 ml)	Category
1	54.22	Tolerated
2	61.32	Tolerated
3	87.92	Over
4	77.95	Tolerated
5	76.88	Tolerated
6	54.89	Tolerated
7	88.76	Over
8	98.54	Over
9	45.67	Tolerated
10	67.89	Tolerated
11	78.62	Tolerated
12	81.21	Over
13	56.23	Tolerated
14	45.78	Tolerated
15	89.78	Over
16	56.75	Tolerated
17	90.12	Over
18	78.39	Tolerated
19	90.89	Over
20	86.72	Over
21	78.34	Tolerated
22	65.45	Tolerated
23	78.21	Tolerated
24	45.12	Tolerated
25	56.97	Tolerated
26	57.89	Tolerated

27	45.9	Tolerated
28	89.78	Over
29	78.98	Tolerated
30	87.64	Over
31	67.93	Tolerated
32	78.67	Tolerated
33	45.21	Tolerated
34	90.78	Over
35	54.94	Tolerated
36	87.51	Over
37	65.89	Tolerated
38	95.82	Over
39	65.7	Tolerated
40	89.65	Over
41	79.04	Tolerated

From 41 respondents included in the experimental group before given treatment, it is found that 27 respondents had a tolerable blood lead level, while the remaining 14 had excessive lead levels. In more detail, it is explained in the following table.

Table 4.2. Percentage of Lead Level Test Results in the Blood of the Experimental Group before Treatment

Category	Respondent	Total	Percentage
Tolerated	1, 2, 4, 5, 6, 9, 10, 11, 13, 14, 16, 18, 21, 22, 23, 24, 25, 26, 27, 29, 31, 32, 33, 35, 37, 39, 41	27	65.85 %
Over	3, 7, 8, 12, 15, 17, 19, 20, 28, 30, 34, 36, 38, 40	14	34.15 %
Total		41	

Table 4.3. Lead Level Test Results in the Blood of the Control Group before Treatment

Respondent	Lead Level (Mg Pb/100 ml)	Category
1	52.44	Tolerated
2	60.14	Tolerated
3	88.3	Over
4	79.25	Tolerated
5	78.91	Tolerated
6	51.76	Tolerated
7	90.01	Over
8	97.59	Over
9	43.88	Tolerated
10	66.62	Tolerated
11	78.26	Tolerated
12	81.89	Over

13	57.33	Tolerated
14	46.77	Tolerated
15	90.35	Over
16	55.74	Tolerated
17	88.12	Over
18	78.81	Tolerated
19	90.32	Over
20	86.81	Over
21	75.12	Tolerated
22	63.78	Tolerated
23	79.02	Tolerated
24	44.33	Tolerated
25	55.9	Tolerated
26	56.09	Tolerated
27	48.27	Tolerated
28	88.97	Over
29	79.11	Tolerated
30	86.34	Over
31	68.31	Tolerated
32	77.95	Tolerated
33	44.77	Tolerated
34	91.22	Over
35	56.98	Tolerated
36	89.98	Over
37	63.38	Tolerated
38	98.89	Over
39	62.1	Tolerated
40	86.23	Over
41	77.4	Tolerated

Meanwhile, from 41 respondents included in the control group before given treatment, it is found that 27 respondents had tolerable blood lead levels while the remaining 14 had excessive lead levels. In more detail, it is explained in the following table.

Table 4.4. Percentage of Lead Level Test Results in the Blood of the Control Group before Treatment

Category	Respondent	Total	Per-centage
Tolerated	1, 2, 4, 5, 6, 9, 10, 11, 13, 14, 16, 18, 21, 22, 23, 24, 25, 26, 27, 29, 31, 32, 33, 35, 37, 39, 41	27	65.85 %
Over	3, 7, 8, 12, 15, 17, 19, 20, 28, 30, 34, 36, 38, 40	14	34.15 %

4.2 Lead Level Test Results after Treatment

After being given treatment in the form of using an anti-lead mask made of water hyacinth for 2 months, blood lead levels in the experimental and control groups got the following results.

Table 4.5. Test Results of Lead Levels in the Blood of the Experimental Group After Treatment

Respondent	Lead Level (Mg Pb/100 ml)	Category
1	45.89	Tolerated
2	61.15	Tolerated
3	70.1	Tolerated
4	69.78	Tolerated
5	69.21	Tolerated
6	52.2	Tolerated
7	76.12	Tolerated
8	94.14	Over
9	40.88	Tolerated
10	53.92	Tolerated
11	75.66	Tolerated
12	77.51	Tolerated
13	48.14	Tolerated
14	47.14	Tolerated
15	72.78	Tolerated
16	52.05	Tolerated
17	73.93	Tolerated
18	69.34	Tolerated
19	79.89	Tolerated
20	75.75	Tolerated
21	76.54	Tolerated
22	59.53	Tolerated
23	69.25	Tolerated
24	53.76	Tolerated
25	53.35	Tolerated
26	56.46	Tolerated
27	43.43	Tolerated
28	42.92	Tolerated
29	69.63	Tolerated
30	77.12	Tolerated
31	64.72	Tolerated
32	72.76	Tolerated
33	42.14	Tolerated
34	80.15	Over
35	51.68	Tolerated
36	84.54	Over
37	72.89	Tolerated

38	72.26	Tolerated
39	63.75	Tolerated
40	75.65	Tolerated
41	70.24	Tolerated

Meanwhile, from 41 respondents included in the experimental group before given treatment, it is found that 38 respondents had tolerable blood lead levels while the remaining 3 had excessive lead levels. In more detail, it is explained in the following table.

Table 4.6. Percentage of Lead Level Test Results in the Blood of the Experimental Group after Treatment

Cate-gory	Respondent	To-tal	Per-centage
Toler-ated	1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 35, 37, 38, 39, 40, 41	38	92,68 %
Over	8, 34, 36	3	7,32 %
Total		41	100 %

Table 4.7 Lead Level Test Results in the Blood of the Control Group after Treatment

Respondent	Lead Level (Mg Pb/100 ml)	Category
1	55.89	Tolerated
2	61.1	Tolerated
3	85.92	Over
4	77.15	Tolerated
5	76.18	Tolerated
6	54.19	Tolerated
7	88.26	Over
8	97.14	Over
9	43.88	Tolerated
10	66.89	Tolerated
11	78.66	Tolerated
12	81.51	Over
13	50.23	Tolerated
14	40.78	Tolerated
15	82.78	Over
16	54.75	Tolerated
17	89.21	Over
18	78.39	Tolerated
19	90.02	Over
20	86.77	Over
21	79.76	Tolerated
22	66.55	Tolerated

23	79.27	Tolerated
24	46.42	Tolerated
25	55.88	Tolerated
26	57.89	Tolerated
27	45.94	Tolerated
28	89.78	Over
29	78.76	Tolerated
30	82.64	Over
31	67.93	Tolerated
32	78.67	Tolerated
33	45.21	Tolerated
34	93.78	Over
35	54.94	Tolerated
36	90.54	Over
37	75.89	Tolerated
38	95.82	Over
39	66.75	Tolerated
40	89.65	Over
41	78.24	Tolerated

From 41 respondents included in the experimental group after given treatment, it is found that 27 respondents had tolerable blood lead levels while the remaining 8 had excessive lead levels. In more detail, it is explained in the following table.

Table 4.8 Percentage of Lead Level Test Results in Control Group Blood after Treatment

Category	Respondent	Total	Percentage
Tolerated	1, 2, 4, 5, 6, 9, 10, 11, 13, 14, 16, 18, 21, 22, 23, 24, 25, 26, 27, 29, 31, 32, 33, 35, 37, 39, 41	27	65.85 %
Over	3, 7, 8, 12, 15, 17, 19, 20, 28, 30, 34, 36, 38, 40	14	34.15 %
Total		41	100 %

4.3 Normality Test

To test the normality of the data distribution in this study, Kolmogorov-Smirnov test is used with the repeated sampling method (Monte Carlo). The decision rule in the Kolmogorov-Smirnov test is that if the resulting Monte Carlo Sig (2-tailed) is greater than 0.05 (sig.> 0.05), it is declared normally distributed. However, if the resulting Monte Carlo Sig (2-tailed) is less than 0.05 (sig. <0.05), the residual is declared abnormal. The results of the normality test of lead levels in blood in the experimental and control groups before given treatment are as follows.

Table 4.9 Kolmogorov-Smirnov Normality Test Results before treatment

	N	Sig.	Result
Control	41	0.122	Normal
Experi-ment	41	0.122	Normal

It can be seen from the table that the initial data normality test in the experimental and control classes shows the value of Sig. = 0.122. Thus, both values have been normally distributed.

Table 4.11 Kolmogorov-Smirnov Normality Test Results after Treatment

	N	Sig.	Result
Control	41	0.293	Normal
Experi-ment	41	0.220	Normal

4.4 Homogeneity Test

To test the homogeneity of variance of the two groups of samples can be done with the F-test. The decision rule in the F-test is if the value of Sig. Levene's Test for Equality of Variance generated is greater than 0.05 (sig.> 0.05), the variance of the data is homogeneous. However, if the resulting Monte Carlo Sig (2-tailed) value is less than 0.05 (sig. <0.05), it can be concluded that the data variance is not homogeneous. The results of the homogeneity test of blood lead levels in the experimental and control groups before given treatment are as follows.

Table 4.10 F-Test Results before Treatment

		Levene's Test for Equality of Variances	
		F	Sig.
Value	Equal variances assumed	.057	.813
	Equal variances not assumed		

Based on the above results, obtained value of Sig. Levene's Test for Equality of Varience is 0.813. Because the value of Sig. 0.813 > 0.05, it can be concluded that the variance of the data is homogeneous.

Table 4.12 F-Test Results after Treatment

		Levene's Test for Equality of Variances	
		F	Sig.
Value	Equal variances assumed	3.135	.080
	Equal variances not assumed		

According to the above results, obtained value of Sig. Levene's Test for Equality of Varience is 0.080. Because the value of Sig. 0.080 > 0.05, it can be concluded that the variance of the data is homogeneous.

4.5 Hypothesis Test

The results of the independent sample T-test from the two groups (experimental and control), are as follows.

Table 4.13 Test Results of Independent Sample T-test

		t-test for Equality of Means		
		t	df	Sig. (2-tailed)
Value	Equal variances assumed	-2.229	.029	.029
	Equal variances not assumed	-2.229	.029	.029

The Sig value is obtained according to the output table "independent sample test" in the "Equation hypothesis" section of 0.029 < 0.05. Therefore, it can be decided to reject H0 and accept H1 as the basis for making decisions on the independent t-test sample. Therefore, it can be concluded that there is statistical significance between the average results of detection of blood lead levels.

5. Discussion

According to the initial data, laboratory test results are obtained which state that 14 of the 41 cigarette factory workers (34.15%) from the experimental group and the control group had blood lead levels that tended to be excessive, while 27 other workers (65.85%) had high blood lead levels that are still tolerable. All data obtained have a Sig value > 0.05 which indicates that the residual value of the distributed data is normal and the two samples have the same variance (homogeneous).

After 2 months, blood lead levels of cigarette factory workers are measured again and an increase in the number of factory workers with tolerable lead levels found in the experimental group, from the previous 27 people (65.85%) to 38 people (92.68%), or it can be interpreted that only 3 workers (7.32%) have excess blood lead levels. Meanwhile, there is no change in blood lead levels of all workers in cigarette factories in the control group. Based on the table of independent t-test results obtained the value of Sig. (2-tailed), the control group and the experimental group after 2 months of treatment are 0.029 < 0.05, thus, it can be concluded that there is a significant difference between the average blood lead levels test results between the groups of cigarette industry workers who are given a mask made from water hyacinth as a filter and a group that is not given special treatment.

The chemical composition of water hyacinth depends on the nutrients grown and the uptake characteristics of the plant. Water hyacinth contains more than 11.5% protein and has good adsorption properties for heavy metals and sulfides. Water hyacinth is able to absorb 1.35 mg/g of cadmium, mercury, and nickel in 24 hours; if the metal is immiscible and the mineral is mixed with other minerals, Cd absorbs 1.23 mg/g, 1.88 mg/g, and Ni absorbs 0.35 mg/g, i.e. 1.77 mg/g and 1.16 mg/g (Aningsih, 2011). In addition, according to Nunung et al, (2008) water hyacinth can also absorb and filter harmful metals such as lead (Pb) (0.176 mg/g), Hg (0.15 mg/g), and Cd and Pesticide for 14 days.

In a working environment in a cigarette factory, lead entering the workers' lungs is absorbed into the blood, then, spreads to various parts of the body. 90% of lead absorbed into the blood is bound to red blood cells which have chronic consequences as lead from the respiratory and digestive tracts that enter the blood and inhibits heme synthesis. Therefore, lead reduces the production of hemoglobin in the blood which can lead to other health problems. Workers in the tobacco industry are required to use PPE to prevent exposure to toxic gases such as lead (Pb) by wearing masks. The masks used by workers are surgical masks. Based on the results of this study, researchers have opinion that the use of masks with filters made from water hyacinth can be effective in providing protection from lead to workers in cigarette factories.

6. Conclusion

According to the research conducted on the effectiveness of anti-lead mask from water hyacinth on cigarette industry employees in Malang city, it can be concluded that there is a difference between the average blood lead level test results, which is significant between the group of cigarette industry workers who are given a mask made of water hyacinth as a filter and the group that is not given special treatment. After 2 months, blood lead levels of cigarette factory workers are measured and found that an increase is found in in the experimental group regarding the number of factory workers with tolerable lead levels from the previous 27 people (65.85%) to 38 people (92.68%), or it can be interpreted that only 3 workers (7.32%) have excess blood lead levels.

References

[1] Adnan. 2001. Bioaccumulation of Trace Metals in The Blood Clam Anadara granosa (Arcidae) and Their Implications for Indicator Studies. Second International Seminar on Environment Chemistry and Toxicology, 26-27 April 2001. Yogyakarta

[2] Al-ayubi, M. C. 2007. Studi Keseimbangan Adsorpsi Merkuri (II) Pada Biomassa Daun Eceng Gondok (Eichhornia crassipes). [Tesis]. Malang. Jurusan Kimia. Fakultas Sains dan Teknologi. UIN.

[3] Anies. 2005. Distribusi Logam Berat Timbal (Pb) dan Cadmium (Cd) di Sedimen, Air dan Bivalvia di Lingkungan Muara Sungai Wiso Jepara. Dip J Of Maq Vol. 3 No. 4

[4] Arifin 2007. Penambangan Timah Inkonvensional: Dampaknya terhadap Kerusakkan Biodiversitas Perairan Umum di Pulau Bangka. Bawal Vol. 2 No.5

[5] Azwar, S. 2009. Reliabilitas dan Validitas. Yogyakarta: Pustaka Pelajar

[6] Azwar, S. 2010. Penyusunan Skala Psikologi. Yogyakarta: Pustaka Pelajar

[7] Budiono, Sugeng A.M., Yusuf, R.M.S., Pusparini A. 2013. Hiperkes dan KK Higiene Perusahaan, Ergonomi, Kesehatan Kerja, Keselamatan Kerja. Semarang : BPUNDIP.

[8] Canggih, R. 2012. Perokok Usia Muda Sasaran Empuk Industri Rokok. http://surabayaehealth.org/pengumuman/perda-kota-surabaya-no-5. Diakses tanggal 10 September 2020.

[9] Cohen, Howard J. & Birkner, Jeffrey S. 2012. Respiratory Protection. Department of Occupational And Environmental Medicine

[10] Covid19.go.id/Protokol-kesehatan-pada-era-kebiasaan-baru diakses pada tanggal 20 November 2020

[11] Gani. 2004. Sediment Analysis and Suspended Particulated Matter. Fisheries and Marine Service Technical Report No. 700, Environmental. Canada

[12] Eshbaugh Jonathan P. 2009. N95 and P100 Respirator Filter Efficiency Under High Constant and Cyclic Flow. Journal of Occupational and Environmental Hygiene 6(1):52-61es DOI: 10.1080/15459620802558196

[13] Ginting, P. 2012. Teknologi Pengolahan Limbah. Jakarta: Penerbit Pustaka Sinar. Harapan.

[14] Gusnita, Dessy. 2010. Pencemaran Logam Berat Timbal (Pb) Di Udara Dan Upaya Penghapusan Bensin Bertimbal. Journal Lapan Vol 13 No.3 September 2012

[15] Hasim.2007. Eceng Gondok Pembersih Logam Berat. www. Kompas. com/kompas – fak/0307/02/in-spirasi/404854.htm-40k, diakses pada 27 Januari 2021.

[16] Harper.2012. Surgical smoke control with local exhaust ventilation: Experimental study. Published in final edited form as Journal Occuppation Environment Hygine National Institutes of Health doi: 10.1080/15459624.2017.1422082

[17] Hernowo. S., M. Sipon. 1999. Kajian Eceng Gondok Sebagai Bahan Baku Industri dan Penyelamatan Lingkungan Hidup di Daerah Perairan. Laporan Penelitian. Samarinda. Fakultas Kehutanan Mulawarman.

[18] Joedodibroto, R. 1983. Prospek Pemanfaatan Eceng Gondok dalam Industri Pulp dan Kertas. Berita Selulosa. Edisi Maret 1983. Vol. XIX No.1. Bandung : Balai Besar Selulosa.

[19] Koes. 2010. Akumulasi Logam Berat (Pb dan Cu) pada Kerang Kepah (Polimesoda erosa) di Sungai Baturusa Mera-wang. Balunijuk: Jurusan Manajemen Sumberdaya Perairan UBB

[20] Kompas Data. 2020. Mengendalikan Populasi Indonesia. Jakarta : Litbang Kompas

[21] Kotler, Philip dan Keller, Kevin Lane. 2009. Manajemen Pemasaran Edisi Terjemahan. Jakarta: Erlangga.

[22] Lubis, N.M.2013. Psikologi Kespro Wanita dan Perkembangan Reproduksinya Ditinjau dari Aspek Fisik dan Psikologi. Jakarta: Kencana Prenada Media Group

[23] Madfi. 2012 . Industri Kota Malang: Perkembangan Pembangunan Industri Kota Malang. Malang : Mulia Pustaka

[24] Nurbakti, Furry D. 2011. Penciptaan Costumer Value Pada Atraksi Wisata Bertema Melalui Brand Experience (Survei pada excursionist De'Ranch di Kabupaten Bandung Barat). Pada Universitas Pendidikan Indonesia. Bandung : tidak diterbitkan.

[25] Puspitasari R. 2007. Laju Polutan dalam Ekosistem Laut. Oseana Volume XXXII No 2 Tahun 2007:21-28

[26] Raharjo. 2012. Analisis Kadar Timbal (Pb) dan Kadmium (Cd) pada Penaeus merguiensis di Pantai Gesek Sedati Si-doarjo. Lent Bio Vol. 1 No. 2

[27] Rama Ellyza, Mutiarasari Utami, Harlina Nurjahjanti. 2011. Faktor-Faktor yang Mempengaruhi Kadar Logam Berat Perkebunan Tembakau di Kota Malang. Jurnal Fakultas Pertanian Universitas Brawijaya

[28] Saputra dan Prasetyo. 2005. Oceanographic Chracteristics of Klabat Bay, Bangka Island, Indonesia. Mar Res Ind 32(2):49-54.

[29] Suma'mur. 1996. Higiene Perusahaan dan Kesehatan Kerja. Jakarta: Gunung Agung.

[30] Soedirman, Suma'mur. 2014. Kesehatan Kerja dalam Prespektif Hiperkes dan Keselamatan Kerja. Jakarta: Penerbit Erlangga.

[31] Soerjani dalam Ramadhan. 2012. Pengaruh Pengendalian Gulma Pada Pertumbuhan Tembakau. Malang. Jurnal Fakultas Pertanian UnivSri S. Kecelakaan Kerja di dunia Industri. Semarang: Tiara Wacana

[32] Witara, K. 2016. New Standard : ISO 45001 - Standard kesehatan dan keselamatan kerja. 54(1), 28–30. Diperoleh dari https://www.iso.org/iso-9001-quality- management.html diakses pada tanggal 20 desember 2020.

[33] Zerrudo. 2010. Approach to Atomic Absorption Spectroscopy. Sidney-Australia: Anal.Chem Consultants Pty, Ltd.