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### EFFECTIVENESS OF VENTILATION CARBON FILTER IN CONTROLLING MICROORGANISMS IN ROOM AIR

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#### ABSTRACT

The house is a place of residence or shelter for individuals or groups. In general, the house has ventilation, ventilation functions as a rotation or exchange of air in the room. The existence of ventilation is very important for air exchange, but the existing air pollution, including microbes, causes air exchange through ventilation into the house which is not safe for health. So there is a need for filtration so that the polluted air can be filtered. . The purpose of this study was to determine the effectiveness of the use of ventilation carbon filters in controlling microorganisms in room air.

This type of research is experimental research with a research design using the Pre and Post Test Only Design

The results showed 1) There was an average decrease in the number of germs in the room by 1412 CFU/m<sup>3</sup> or 62%. 2) There is an average decrease in the number of fungi in the room by 17 CFU/m<sup>3</sup> or 44%. 3) there is a significant difference in reducing the number of germs in the room air before and after being given a carbon filter ventilation with p-Value = 0.000. 4) There is a significant difference in the reduction of mold numbers in room air before and after being given a carbon filter ventilation p-Value = 0.035. .

The recommendations given are that it is hoped that the community can use carbon filters as adsorbents for air pollutants that enter the room. Carbon filter ventilation that has been used needs to be washed and activated so that it can adsorb air pollutants more optimally. The room still has to be cleaned regularly to reduce air pollution which poses a risk to the health of occupants.

**Keywords:** Carbon Filter Ventilation, Germ Number, Fungus Number

#### INTRODUCTION

Another source of air pollution that occurs in Jambi City is air pollution due to industry and motor vehicle fumes. Many rubber industries in the city of Jambi cause residential areas near the rubber industry to experience unpleasant odor pollution. High exhaust fumes cause air quality in Jambi City to become unhealthy.

At the end of 2019 there was a pandemic of the Corona Virus Disease (Covid-19) caused by the Corona Virus. In April 2020 there were 1,521,809 cases of Covid-19 in the world and caused 88,653 deaths. In April 2020 in Indonesia there were 3,630 cases of Covid-19 and 280 people died<sup>1</sup>

Since the Covid-19 pandemic, people have experienced obstacles to living a normal life due to restrictions that need to be made to prevent transmission of the virus. The government's efforts to prevent and control the increase in Covid-19 cases are appealing and making regulations that require people to stay at home. Carry out learning activities at home for school children and work from home for employees or employees in accordance with the rules set by their respective workplaces.

Transmission of Covid-19 and respiratory tract diseases is caused by microorganisms or germs, both viruses and bacteria, in the air. One source of air pollution, namely microbes, can occur, including air quality outside the home.

The house is a place of residence or shelter for individuals or groups. In general, the house has ventilation, ventilation functions as a rotation or exchange of air in the room. The existence of ventilation is very important for air exchange, but the existing air pollution, including microbes, causes air exchange through ventilation into the house which is not safe for health. So there is a need for filtration so that the polluted air can be filtered.

One of the methods used to reduce polluting materials in the air is the use of coconut shell waste as an absorbent (absorbent medium) which has previously been converted into activated charcoal. Activated carbon can be made from materials containing carbon, one of the materials containing activated carbon is coconut shell.

Coconut shell activated charcoal is able to reduce the concentration of various pollutants in the air because it has good adsorption power. Air pollutant sources that enter the room through ventilation can be absorbed using a carbon filter / filter that is installed on the ventilation. Based on this, researchers will conduct research related to the effectiveness of ventilation carbon filters in controlling germ numbers in room air.

The general objective is to know the effectiveness of the use of ventilation carbon filters in improving room air quality. Specific objectives a) To find out the reduction in the number of germs in room air after using carbon filter ventilation. b) To find out the decrease in the number of room air molds after using carbon filter ventilation. c) To determine the effectiveness of using carbon filter ventilation in controlling the number of germs in room air. d) To determine the effectiveness of using carbon filter ventilation in controlling mold numbers in room air.

## **MATERIALS AND METHODS OF WORK**

This type of research is experimental research with a research design using a Pre and Post Test Only Design. The population in this study is the air in the room. The research subjects were taken using the Purposive Sampling technique. The subjects in this study were examination of air quality parameters (microorganisms, namely the number of germs and fungi) which were carried out in 2 rooms (rooms) with 3 repetitions. The room used as the object of research with the criteria has the same room area, room walls made of the same building materials and relatively the same indoor environmental conditions.

This research will be carried out in Kasang Village, East Jambi District, Jambi City. The tools or instruments used are carbon filter ventilation, Plate Count Agar (PCA) media for checking the number of germs. Potato dextrose agar (PDA) media with 500 mg chloramphenicol for examination of fungal counts, germ culture tools, cameras and . Stationery

## RESULTS AND DISCUSSION

### 1. Reducing the number of germs

The results of research on reducing germ numbers in room air before and after being given a carbon filter ventilation are as shown in table 1 below:

**Table1. Results of Measurement of Germ Numbers in the Air Before and After Giving Carbon Filter Ventilation**

No	Number of bacteria	Measurement/ Amount (CFU/m <sup>3</sup> )		Average (CFU/m <sup>3</sup> )
		1	2	
1	Before installing the Carbon Filter Vent	2400	2200	2300
2	After installing the Carbon Filter Vent	893	882	888
	Decline	1507	1318	1412
	Percentage (%)	63	60	62

Based on table 1 it is known that the decrease in the number of germs in the room is an average of 1412 CFU/m<sup>3</sup> or 62%. This shows that activated charcoal has a high absorption power so that it can properly bind air pollutant materials including microbes.

### 2. Decreasing Number of Mushrooms

The results of the research on reducing Fungal Numbers in room air before and after being given a carbon filter ventilation are as shown in table 2 below:

**Table 2. Results of Measuring Fungal Numbers in the Air Before and After Giving Carbon Filter Ventilation**

No	Mushroom Figures	Measurement/ Amount (CFU/m <sup>3</sup> )		Average (CFU/m <sup>3</sup> )
		1	2	
1	Before installing the Carbon Filter Vent	37	40	38
2	After installing the Carbon Filter Vent	21	22	22
	Decline	16	18	17
	Percentage (%)	43	45	44

Based on table 2 above, it can be seen that the decrease in the number of fungi in the room is an average of 17 CFU/m<sup>3</sup> or 44%. Charcoal is a porous solid containing 85-95% carbon, produced from carbon-containing materials by heating at high temperatures. When heating takes place, efforts are made to prevent air leaks in the heating chamber so that the material containing carbon only carbonizes and does not oxidize. Charcoal is activated by chemical factors or by heating at high temperatures. Thus, charcoal will experience changes in physical and chemical properties. Such charcoal is referred to as activated charcoal / activated carbon.

activated carbon is a carbon compound whose adsorption capacity has been increased by carbonization and activation. Activated carbon is an amorphous carbon compound, which can be produced from carbon-containing materials or from charcoal which is treated in a special way to obtain a wider pore surface. Activated carbon can be used to remove odor, taste, color and other organic contaminants<sup>5</sup>.

Activated carbon can be in the form of powder or granules, activated carbon has a large surface area per unit weight, because it has so many fine pores (micro pores). This situation causes activated carbon to absorb gas, liquid and other dissolved substances. Activated carbon

raw materials come from animals, plants, waste or minerals that contain carbon, including: bones, softwood, husks, corn cobs, coconut shells, coconut coir, sugar cane pulp, paper-making waste, sawdust, wood hard and coal.

The installation of carbon filter ventilation has an impact on filtering air pollutants that enter the room through ventilation. Clean air entering the room will cause the air quality in the room to be good and reduce the growth of microorganisms including fungi. There are several types of fungi that are commonly found in indoor air and have an impact on human health, namely *Alternaria*, *Aspergillus*, *Cladosporium*, *Penicillium*, and *Stachybotrys*. Only a small number can infect humans, but many can grow on buildings and have the potential to reduce indoor air quality. Health effects caused by mushrooms such as allergic reactions, toxic effects, irritation and infection. Air pollution that occurs in the room is influenced by several factors including the condition of the building,

### 3. The difference in reducing the number of germs before and after being given a carbon filter ventilation

The results of the T test on the decrease in the parameter number of germs in room air before and after being given a carbon filter ventilation can be seen in table 3 below:

**Table 3**  
**The results of the T-Test for Reducing Germicidal Number Parameters in Room Air Before and After Giving Carbon Filter Ventilation**

Number of bacteria	Means	Std Deviation	P Value
In the room before and after being given a Carbon Filter Ventilation	1286,667	268.97336	0.000

Based on Table 3, it shows that there is a significant difference in the decrease in the number of germs in the room air before and after being given a carbon filter ventilation p-Value = 0.000.

Adsorption is the event of taking substances in the form of gases, vapors and liquids by the surface or interface without penetration.

states that adsorption in activated carbon occurs physically, the adsorption process occurs due to the properties of activated carbon as an absorbent, molecular filter, catalyst and ion exchange<sup>9</sup>. Activated charcoal is an adsorbent that has very small diameter pores that can absorb gas, so that the gas that passes through it will be bound and experience an attractive force with the pores of the activated carbon. The mechanism for absorption of activated carbon

is as follows<sup>10</sup>: a). The adsorbate molecules move towards the outer layer of the activated carbon adsorbent. b). Activated carbon as a whole group has a large pore surface area so that it can hold adsorbate. c). Some of the adsorbate is adsorbed on the outer surface, but most of it is adsorbed in the pores of the adsorbent by diffusion.

#### 4. Differences in the decrease in the number of fungi before and after being given carbon filter ventilation

The results of the T test on the decrease in the number of mold parameters in room air before and after being given a carbon filter ventilation can be seen in table 4 below:

**Table 4**  
**The results of the T-test for Decreasing Fungus Number Parameters in the Air Before and After Giving Carbon Filter Ventilation**

Mushroom Figures	Means	Std Deviation	P Value
In the room before and after being given a Carbon Filter Ventilation	18.33333	15.60342	0.035

Based on Table 4, it shows that there is a significant difference in the decrease in the number of fungi in the room air before and after being given a carbon filter ventilation p-Value = 0.035.

Even though there is a very significant relationship, the decrease in germ numbers is not below the set threshold value. According to the Ministry of Health<sup>11</sup> the requirements for the number of germs in the air are <700 CFU/m<sup>3</sup> while the results obtained using a ventilation carbon filter show an average germ rate of 888 CFU/m<sup>3</sup>. Likewise, the fungal rate was 0 CFU/m<sup>3</sup> while the results obtained using a carbon filter ventilation showed an average fungal rate of 17 CFU/m<sup>3</sup>.

Many factors cause the number of germs and fungi in room air to be still above the threshold value. Microorganisms don't just float in the air. Air is basically not a place for the growth and reproduction of microorganisms because the composition of the air is not suitable. In the open air, most bacteria come from the soil. Microorganisms in the air may be carried by dust, moisture, wind and room occupants<sup>12</sup>. Microorganisms in the air usually stick to the surface of the ground, floor, room, room furniture and room occupants. Most of these microorganisms are saprophytes and are non-pathogenic, however if their numbers increase relatively large they can have the same potential as pathogenic bacteria<sup>13</sup>.

Generally people will emit droplets which can affect the amount of mikroorganism in the air. Microorganisms are spread by droplets expelled through the nose or mouth during coughing, sneezing and talking<sup>14</sup>. Small droplets remain suspended in the air for long periods of time, while larger droplets fall rapidly as dust. As long as there is activity in the room, dust returns to fly as a result of air movement.

Therefore, to control microorganisms in the room, it is necessary to do a thorough management, not only filtering incoming air, but also maintaining the cleanliness of the room properly. Because the existing dust will fly back due to the activities of the occupants in it so that the air quality in the room will decrease.

## CONCLUSIONS AND RECOMMENDATIONS

The conclusion in this study is that there is a decrease in the number of germs and mold numbers in the room before and after being given a carbon filter ventilation. There is a significant difference in reducing the number of germs and mold numbers in the room air before and after being given a carbon filter ventilation.

Suggestions that can be conveyed are that it is hoped that the community can use carbon filters as an adsorbent for air pollutants that enter the room. The ventilation filter carbon that has been used needs to be washed and activated so that it can adsorb air pollutants more optimally. The room still has to be cleaned regularly to reduce air pollution which poses a risk to the health of occupants.

## BIBLIOGRAPHY

1. [www.kompas.com](http://www.kompas.com). 2020. April 9 Corona Update: 1.52 Million People Infected, 332,170 Recovered. Accessed April 20, 2020.
2. Pujiyanto, 2010, Manufacture of Activated Carbon, <http://lib.ui.ac.id>. accessed 16 November 2019
3. Notoatmodjo, S. 2010. Health Research Methodology. Rineka Cipta. Jakarta.
4. Sembiring, Meilita Tryana and Tuti Sarma Sinaga. 2003. Activated Charcoal (Introduction and Manufacturing Process). USU digital library. <http://library.usu.ac.id/download/ft/industri-meilita>. Accessed November 30, 2019
5. Nurullita, Ulfa and Mifbakhuddin. 2015. Indoor Carbon Monoxide (CO) Adsorption With Coconut Shell Activated Carbon And Durian Peel. The 2nd University Research Colloquium 2015. 297-306. <http://jurnal.unimus.ac.id>. Accessed 3 November 2019
6. Subekti, Purwo. 2009. The Effect of Using Exhaust Gas Absorbing Media on Air Pollution Control Devices for Diesel Engine Vehicles. APTEK JOURNAL. 1/1: 1-11. On line. Available at <http://www.ejournal.upp.ac.id/index.php/aptk/article>. Accessed November 10, 2019

7. Kusuma, N. HR. 2017, Contaminant Fungus Contamination in the Borneo Lestari Banjarbaru Health Analyst Lecture Room Using Air Conditioner (Ac), <http://repo.stikesborneolestari.ac.id>
8. Ramdja, A. Fuadi et al. 2008. Manufacture of Activated Carbon from Coconut (Cocos nucifera) fronds. Journal of Chemical Engineering. 2/15: 1-8. Available at Mubarak, 2012. Public Health Concepts and Applications in Midwifery. Salemba Medika Publisher, Jakarta
9. Maryanto, Dicky et al. 2009. Reducing Levels of Carbon Monoxide (CO) Exhaust Emissions With the Addition of Activated Charcoal in Motor Vehicles in Yogyakarta. KES MAS. 3/3: 198-205. On line. Available at <http://www.journal.uad.ac.id/index.php/KesMas/article/viewFile/1110/pdf>, Retrieved 24 November 2019.
10. Basuki, KT, Setiawan, B., and Nurimaniwathy, 2008, Reducing CO and NO<sub>2</sub> Concentrations in Exhaust Emissions using Coconut Shell Charcoal Inserted with TiO<sub>2</sub>, <http://www.digilib.batan.go.id>, accessed 20 November 2019.
11. Ministry of Health of the Republic of Indonesia, 2011. Permenkes Number 1077/Menkes/Per/V/2011 Concerning Guidelines for Air Sanitation in Home Rooms, Jakarta
12. Irianto, K. 2007, microbiology reveals the world of microorganisms volume 1. Bandung: Yrama Widya..
13. Chan PMJE. 2008. Fundamentals of Microbiology, Jakarta: UI Press.
14. Waluyo L. 2009, Environmental Microbiology. Malang: Muhammadiyah University. Malang Press..