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MORALITY BEFORE KNOWLEDGE

Air pollution threatens health and climate change in Jakarta

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ABSTRACT
Background: Currently air pollution is one of the main problems in Jakarta. Due to the lifestyle of the people of Jakarta who are more consumptive of vehicles and also the number of skyscrapers so that this has an impact on increasing air pollution which results in climate change and also become one of the causes of decreased child health. The purpose of this research is to determine the air pollution in Jakarta through the NAFAS application, whether or not it is in accordance with global air quality standards. **Methods:** The data of this study are Air Pollution Particles of PM 2.5. while samples are taken periodically for up to a month. **Findings:** One of the particles in air pollution that is being discussed is PM 2.5. PM 2.5 comes from both natural and human sources. Particulate matter (PM) is a type of particle that consists of solid or liquid droplets found in the air. **Conclusion:** These particles are also sometimes referred to as aerosols. These particles come from both natural and human sources, such as fields, fires,dirt roads, and construction sites. Many particles are formed in the air as a result of complex reactions caused by chemicals in the atmosphere from sources such as power plants, factories, and vehicles.

KEYWORDS: air pollution; Air Quality Index (AQI); climate change; PM 2.5.

1. Introduction

Currently, air pollution is a significant issue in Jakarta. The consumptive lifestyle of Jakarta's residents, who prefer using private vehicles, along with the proliferation of skyscrapers, contributes to the escalation of air pollution, which impacts climate change and reduces children's health. A component of air pollution that is of concern is the PM 2.5 particle, which originates from both natural and human activities.

Particulate Matter (PM) is a type of particle that consists of solid or liquid droplets present in the air, often referred to as aerosols. These particles stem from both natural and man-made sources, such as agricultural lands, fires, unpaved roads, and construction sites. Many particles are formed in the air due to complex chemical reactions from atmospheric chemicals emanating from sources like power plants, factories, and vehicles.

1.1 Global Air Quality Standards

The WHO standard for PM2.5 is an annual average of 10 µg/m3 and a 24-hour average of 25 µg/m3. The World Health Organization (WHO) Air Quality Guidelines are the actual

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global air quality standards. These guidelines recommend standards and targets for air pollutants that pose health risks to humans and serve as a reference for countries to establish their own standards. The guidelines were first published in 1987 and have been revised in 1997 and 2005. Each update reflects the latest scientific assessment of the health impact of air pollution. The guidelines are intended for global use, but the WHO recognizes that countries will set their own standards based on a balance of health risks, technological feasibility, economic considerations, and socio-political factors. Air quality measurements are typically based on the daily average concentrations of particulate matter (PM) per cubic meter of air volume (m3). These concentrations are measured in micrograms per cubic meter (μg/m3). Two types of PM are measured: PM10 and PM2.5. PM10 is easier to measure because the particles are larger – they have a diameter of 10 microns or less – while PM2.5 particles are much smaller, with a diameter of 2.5 microns or less.

1.2 Major Contributors to Jakarta's Air Pollution

Indonesia's air quality has significantly deteriorated over the past twenty years. At the end of the 20th century, the country's air was relatively clean; now, it is among the world's twenty most polluted countries. The most severe increase in air pollution occurred between 2013 and 2016, largely due to the rise in the number of coal-fired power plants, vehicles, and more frequent large-scale wildfires.

1.3 Jakarta's Air Pollution Worsening Since 2017

Since 2017, air pollution has continued to rise. In 2019, Jakarta's air quality was five times worse than the WHO guidelines, and Jakarta's average Air Quality Index (AQI) increased by 69% between June 2017 and June 2020. Most months of the year, moderate or healthy AQI scores are now rare. In other words, the air is more often unhealthy than healthy.

1.4 Reduction in Life Expectancy for Jakarta Residents

Research in 2016 indicated that the average Jakarta resident lost 2.3 years of life expectancy due to air pollution, even though as recently as 2013, air pollution had little impact on life expectancy in the city. And the situation is worsening: the 2020 Air Quality Life Index shows that air pollution leads to a 4.8-year reduction in the average life expectancy of Jakarta residents. The surrounding areas of Bekasi, South Tangerang, and Bogor fare even worse, with residents losing around 5 years of life due to air pollution. Jakarta's poor air quality results from various pollutants: vehicle emissions, coal-fired power plants, manufacturing, household emissions, construction, dust, domestic waste burning, and seasonal wildfires. It is believed that a significant portion of Jakarta's air pollution comes from vehicles. Typically, the city's air quality improves during the Idul Fitri holiday at the end of Ramadan. However, during Idul Fitri 2019, air pollution remained high, with an AQI over 210. This was the highest AQI in the world on those days.

1.5 Problem Statement

The problem formulation of this research is whether the Air Pollution in Jakarta, containing PM 2.5 particles, complies with the global air quality standards set by WHO.

1.6 Research Objectives

The purpose of this research is to determine whether the air pollution in Jakarta, as measured through the NAFAS application, aligns with global air quality standards.

2. Methods

2.1 Research Framework

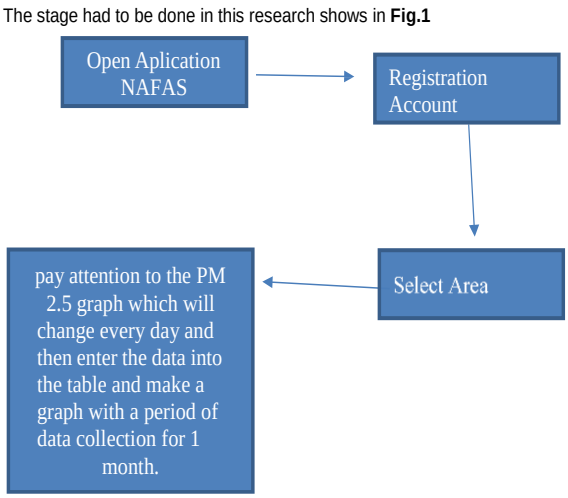

Fig 1. The stage had to be done in this research shows

The data of this study are Air Pollution Particles of PM 2.5. while samples are taken periodically for up to a month.

2.2 Data Analysis Method

The results of PM 2.5 will be used for descriptive research to explain the air quality conditions. The hypotheses that will be tested in this study using using air in the Jakarta area is the PM 2.5 standard for air quality in global air quality standards.

3. Result and Discussion

3.1 Here's DKI Jakarta in June 2022

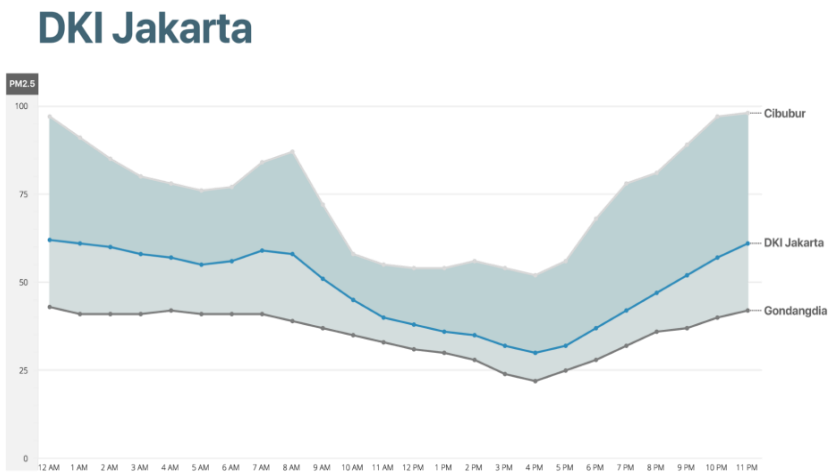

Fig 1. Here's the last 1 year of data from sensors that have been installed in residential neighborhoods – Brawijaya, Kebayoran Baru, Menteng, and Serpong

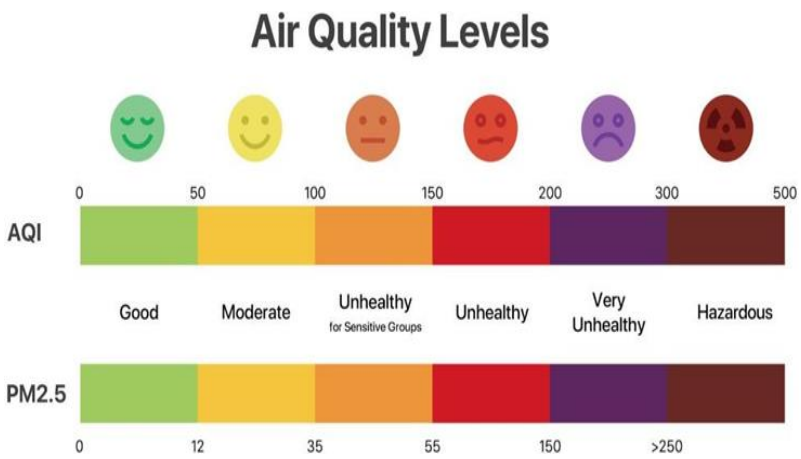

Fig 2. Using nafas sensor we took a look at what it has looked like in the mornings in different locations

3.2 Here's Surabaya in June 2022

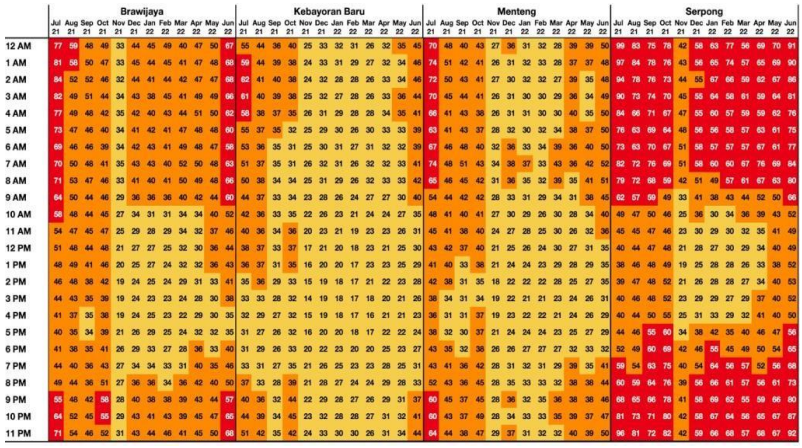

Fig 3. You can see that on average, the morning time has PM2.5 levels that are far above the 15 µg/m3 daily exposure recommendation from the WHO.

3.3 Here's the Same School in Serpong and Menteng/Brawijaya/Kebayoran Baru in March 2022. Look at How Different the Air Quality an be From Day to Day!

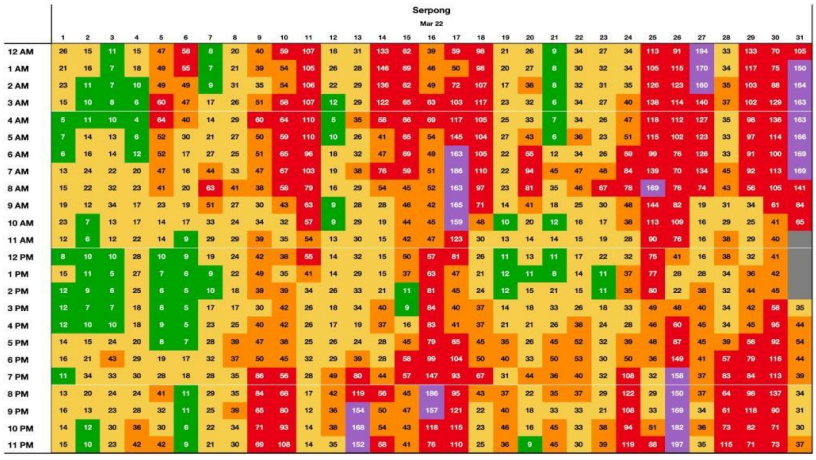

Fig 4. Serpong

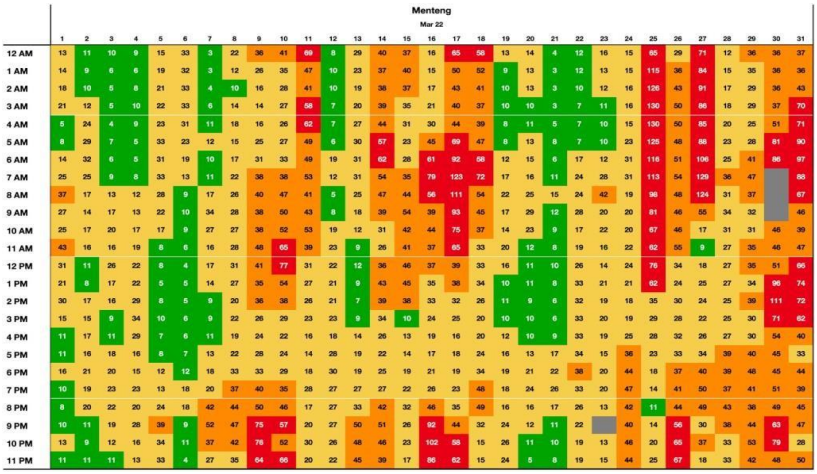

Fig 5. Menteng

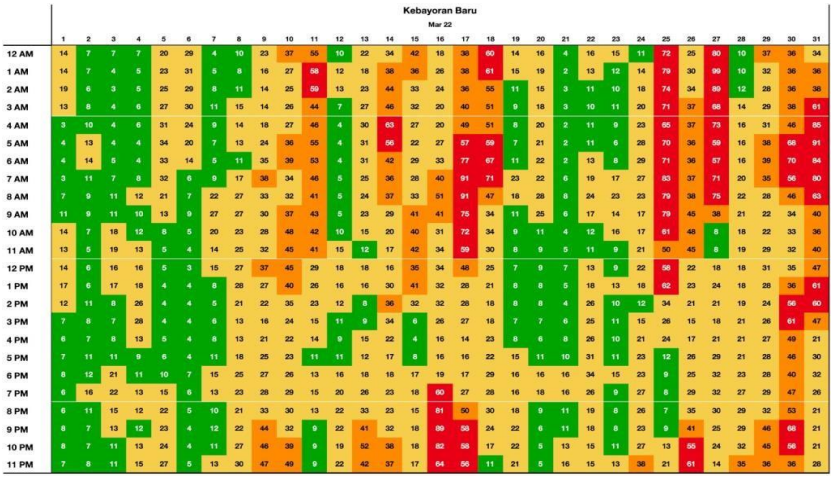

Fig 6. Kebayoran Baru

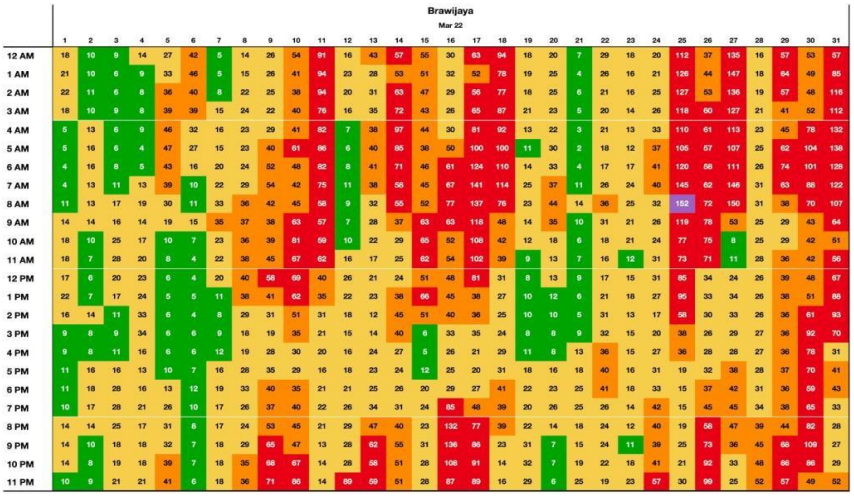

Fig 7. Brawijaya

One of the most misleading statements we have seen is that trees can be planted to enhance air quality and eliminate air pollution. A study from Sweden documented that trees and other higher canopy vegetation can increase the pollution concentration inside a street canyon by reducing turbulence and mixing fresh air with polluted air inside the canyon. Another interesting fieldwork experiment in Shanghai showed an increase of up to 30% in

PM2.5 concentration near the buildings due to trees. The primary pollutant we face in Indonesia is PM2.5, which as we already know is minimally affected by the number of trees we have. According to a study from the US EPA, removal of PM2.5 from the air by trees is minimal up to 0.24%. For reference, the top 5 worst places in June 2022 in Indonesia were, Cipayung – 74, Cibubur – 74, Serpong – 70, Cibinong – 70, and Tambun Selatan – 67.

The guideline from the World Health Organization (WHO) for yearly exposure is just 5 µg/m3. This explains that to get to 5 µg/m3, we will need PM2.5 reductions of Cipayung, 93.2%, Cibubur, 93.2%, Serpong, 92.8%, Cibinong, 92.8%, and Tambun Selatan, 92.6%.

To prove the point, here is some data from Nafas sensors around green areas showing the air quality.

a. SERPONG - one of the most "green" areas according to various published results.
   2021 PM2.5 - 51
   2022 PM2.5YTD – 55

Fig 8. The PM2.5 level is about 28% worse than DKI Jakarta which has much fewer trees

b. CIBINONG - one of the most "green" areas according to various published results.
   2021 PM2.5 - 57
   2022 PM2.5 YTD - 61

Fig 9. The PM2.5 level is about 42% worse than DKI Jakarta which has much fewer trees

c. TARUMAJAYA - one of the most "green" areas according to various published results.
2021 PM2.5 - 51
2022 PM2.5 YTD – 43

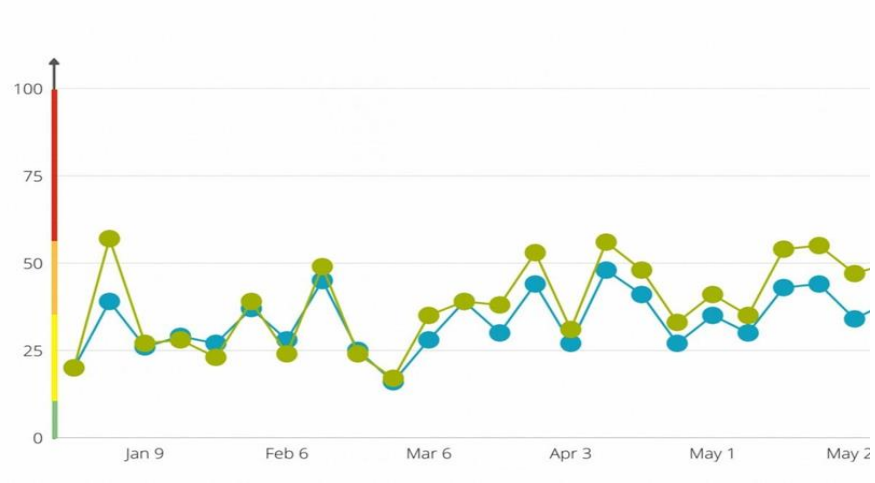

Fig 10. The PM2.5 level is about 16% worse than DKI Jakarta which has much fewer trees

Now, this isn't always the case. Here is the data from one of the Nafas sensors in another green area.

d. GUNUNG GEULIS - a neighborhood in the Sentul area.
2021 PM2.5 - 25
2022 PM2.5 YTD - 21

Fig 11. The PM2.5 level is about 51% better than DKI Jakarta which has much fewer trees

The atmosphere and weather have a greater impact on air quality. Based on those data, it can be concluded that we are far more dependent on the weather and atmosphere in determining air pollution levels. The greatest percentage of improvements in air quality tended to occur during windy conditions with low boundary layer heights. University Corporation For Atmospheric Research (UCAR) mentioned the atmospheric conditions that create weather, such as wind, air pressure, temperature, and humidity, affect air quality. Powerful winds are more able to transport air pollution from one area to another, even across countries. An interesting study mentioned that the presence of trees can enhance

particulate matter concentration by changing air temperatures, emitting volatile organic compounds, and changing energy consumption. PM2.5 levels can increase if trees trap particles beneath their canopies near emission sources. Now, we all know that urban trees are good for reducing gases in air pollution, but are not the most optimal solution to reduce the concentration of PM2.5 in our air. Planting trees might aid in the reduction of air pollution, but local scale designs of urban trees are important to be considered.

4. Conclusion

You can a see that on very average, the morning time has a PM2.5 levels that are far above the 15 μg/m3 daily exposure recommendation from the WHO. So The results for PM 2.5 observations contained in air pollution in Jakarta have not met global air quality standards.

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All author contributed fully to the writing of this article.

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Informed Consent Statement

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Conflicts of Interest

The author declare no conflict of interest.

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