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Identification of Air Pollution Level in Institute Technology Sumatera, South Lampung

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Institut Teknologi Sumatera (ITERA) has the potential to generate air pollution due to the development for the next twenty years. This study aims to identify and analyse pollutant concentrations level in the ITERA. The parameters used are Sulphur dioxide (SO2), Nitrogen Dioxide (NO2), Ozone (O3), Hydrocarbon (HC), PM10, and Dust (TSP) based on PP RI No.41 at 1999 of National Ambient Air Quality Standard. The measurement results show the ambient air quality the highest concentration of pollutant occurred at the ITERA main gate is hydrocarbon which had the concentration 453 μg/m^3 below the national standard at both sampling points.

Keywords: Environmental monitoring and Pollution level

1. INTRODUCTION

ITERA is a state institute of technology based in Jati Agung, South Lampung. ITERA has great potential in development over the next 20 years, along with some challenges like risk of water, air and soil pollution. Air pollution is the presence of undesirable materials in the air, with a sufficiently large quantity that allow harmful health effects [1]. High frequency of mobilization will increase the use of convenient transportation, such as motorcycle includes the amount of air pollution. The source of air pollution may occur from stationary sources such as industrial activity, natural or other processes and also from mobile sources like emissions of motor vehicle. The air pollution from motor vehicles contributes 70% carbon monoxide (CO), 100% Plumbum (Pb), 60% hydrocarbon (HC) and 60% nitrogen oxide (NOX). Even some areas with high traffic density indicate pollutants such as Pb, ozone (O), and CO exceed the threshold [2]. High number of motor vehicle usage by students and lecturers in ITERA, cause increased air pollution. Therefore, ambient air quality must be monitored since the beginning to know the changes and impact that occur.

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2. METHODOLOGY

2.1 Data and Location

This sampling was conducted at 23 September 2017 at 2 locations such as ITERA main gate and the zero point of ITERA. The tools was used in are Air Quality Laboratory, air measurement sensors that were Sulfur dioxide (SO_2), Nitrogen Dioxide (NO_2), Ozone (O_3), Hydrocarbon (HC), PM10, Dust (TSP). In addition impinge, HVAS, barometer, anemometer, data recording device to record sensor readout data, Spector UV-VIS, and stopwatch to find out the measurement time [3, 4]. Measurements of air quality level performed only one time at each measurement point. In this study, two test points were taken that represented the area of high pollution concentration and carried out from noon for one hour per test point [5]. The tools was arranged to make one data every five minutes, so there were twelve datas in one hour.

The tools can read data at intervals of every second, minute to hour. But the time interval does not affect the results because it will be estimated according to the actual measurement time (see Figure 1).

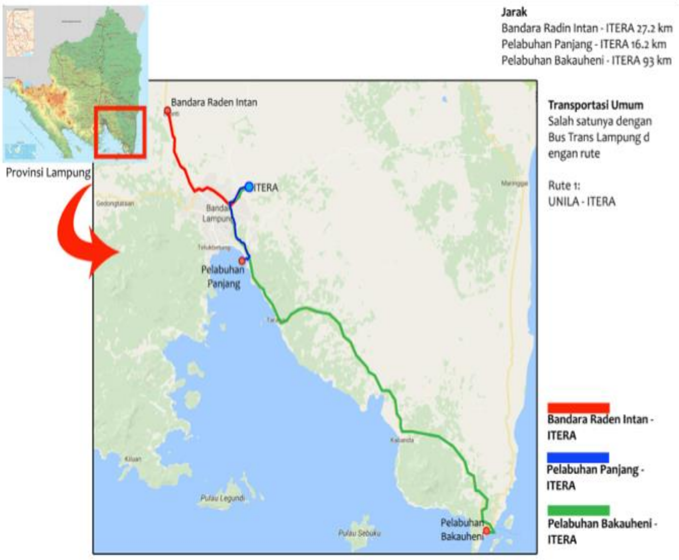

Figure 1. Location Research

3. RESULT AND DISCUSSION

In order to achieve the result, the pollution by sulfur oxide is mainly caused by two colorless gas components, sulfur dioxide (SO_2) and sulfur trioxide (SO_3) and both are called SO_x. Sulfur dioxide has a strong odor and unburned odor in the air, whereas sulfur trioxide is a non-reactive component. Burning sulfur-containing materials such as coal will produce both forms of sulfur oxide, but the relative amounts of each are not affected by the amount of available oxygen. The presence of SO_3 in the form of gas is influenced by the amount of available oxygen. The presence of SO_3 in gaseous form is possible only if the concentration of water vapor is very low. If water vapor is present in sufficient quantities as usual, SO_3 and water will soon combine to form sulfuric acid (H_2SO_4) with the reaction as follows: $SO_3 + H_2O \rightarrow H_2SO_4$, therefore the normal component is present in the atmosphere instead of SO_2 but H_2SO_4. Here, The effect of SO_x on plants can be influenced by two factors: the influence of SO_2 concentration and contact time. Damage to plant tissue occurs when direct contact with SO_2 at high concentrations in a short period of time, with symptoms of some parts of the leaves being dry and dead, and usually the color of loading. Contact with SO_2 at low concentrations over time causes chronic damage, characterized by yellowing of leaf color due to inhibition of chlorophyll formation mechanisms. Acute damage to the plant is due to the ability of the plant to convert the SO_2 absorbed through the roots, and if accumulation is high enough, there is chronic symptoms accompanied by leaf fall.

Furthermore, The effect on humans and animals, SO_x at concentrations far higher than the required concentration is respiratory system irritation. Several studies have shown that throat irritation occurs at concentrations of 1-2 ppm. SO_2 is considered a harmful pollutant for health, especially against the elderly and patients with chronic illnesses in the respiratory and cardiovascular systems-individuals with such symptoms are very sensitive to contact with SO_2, albeit at relatively low concentrations, eg 0.2 ppm or more. The result of SO_2 measurement at both of location sampling point was 15 µg/Nm^3, which is fulfill the specified quality standard (900 µg/Nm^3) based on *Peraturan Pemerintah Republik Indonesia* No. 41 at 1999. For now, there was no effect on environment such as spotted foliage and yellowing, excessive corrosive of the apparatus, or disturbances of breathing and sore eyes.

Nitrogen oxide (NO_x) is an atmospheric gas group consisting of nitrogen oxide (NO) and nitrogen dioxide (NO2) gases. In fact other forms of nitrous oxide still exist, but these two gases are most commonly encountered as air pollutants. Nitrogen oxide is colorless and odorless also preferably nitrogen dioxide has a reddish-brown and sharp-smelling color. The amount of NO_x pollution is not caused by the oxides, but because of their role in the formation of photochemical oxygen which is a harmful component in the smoke. The presence of NO_x in the atmosphere at a high concentration of 3.5 ppm occurs necrosis or leaf woven damage. NO_2 at a concentration of 5 ppm inhaled for 10 minutes by humans will result in a little difficulty in breathing. The content of NO_2 in the air comes from the combustion of nitrogen gas. The result of NO_2 measurement at main gate was 3 µg/Nm^3 and 2 µg/Nm^3 over zero point of ITERA. It means that the results were below the air quality standard (400 µg/Nm^3). Thus, Ozone is an important photochemical oxidant in the troposphere. The photochemical reaction with the help of other pollutants such as NO_x, and Volatile organic compounds. Short-term exposure can induce inflammation of the lungs and interfere with lung and cardiovascular defense functions. A long-term exposure may induce the occurrence of asthma, even pulmonary fibrosis. Epidemiological studies in humans show high ozone exposure may increase the number of exacerbations/ asthma attacks.

Ozone (O_3) is a chemical compound that has 3 unstable bonds. In the atmosphere of ozone is formed naturally and lies in the stratosphere layer at an altitude of 15-60 km above the earth's surface. The function of this layer is to protect the Earth from the radiation of ultraviolet rays emitted by sunlight and harmful to life. The content of O_3 at the main gate area point was 2 µg/Nm^3 and zero point of ITERA was 5 µg/Nm^3, which the O_3 quality standard by PP RI. 41 of 1999 are 160 µg/Nm^3. Furthermore, As an air pollutant, Hydrocarbons can be derived from industrial processes emitted into the air and then a photochemical source of ozone.

HC is the primary pollutant since it is released directly into the ambient air, while the photochemical oxidant is the secondary pollutant produced in the atmosphere from the reactions involving the primary pollutant. Industrial activities that potentially cause contamination in the form of HC are industrial plastics, resins, pigments, dyes, pesticides and rubber processing. The estimated industrial emissions of 10% in the form of HC. HC sources can also come from means of transportation. Bad engine condition will produce HC. In general, in the morning HC levels in high air, but during the day decreased. In the afternoon the level of HC will increase and then decrease again at night. The presence of hydrocarbons in the air, especially methane, can be derived from natural sources, especially biological processes of geothermal activity such as exploration and utilization of natural gas and petroleum. A considerable amount also comes from the process of decomposition of organic matter on the soil surface. Similarly, waste disposal, forest fires and other human activities have a significant role in producing atmospheric hydrocarbon. Hydrocarbons in the air will react with other materials and will form new bonds called polycyclic aromatic hydrocarbons (PAHs) that are common in industrial areas and dense traffic. When PAH is included in the lungs will cause injury and stimulate the formation of cancer cells. The result of hydrocarbon analysis of main gate area was 453 μg/Nm^3 and 345 μg/Nm^3 at other sampling point. Compared to the air quality standards this result was below the threshold (30000 μg / Nm^3).

The influence of dust particles of solid or liquid form residing in the air is highly dependent on its size. The size of dust particles that endanger health generally runs from 0.1μ up to 10 μ generally the dust particle size of about 5 microns is an air particle that can go directly into the lungs and settle in the alveoli. However, it does not mean that particle sizes greater than 5 μ are harmless because larger particles can interfere with the upper respiratory tract and cause irritation. This situation will be more severe in case of a synergistic reaction with SO_2 gas in the air as well. In addition to negatively affecting health, dust particles can also interfere with the invisibility of the eye and also perform various chemical reactions in the air. Air particles in solid form less than 10 μm in diameter are commonly referred to as PM10 (particulate matter) believed by environmental and public health experts to trigger respiratory infections, because the solid particles of PM10 are very apprehensive as they have a greater ability to penetrate into in the lungs. While the hair inside the nose can only filter dust larger than 10 μm.

The result of measurement of PM10 content shows that the content at main gate point was 20 μg/Nm^3 and 23 μg/Nm^3 in zero point of ITERA. It were much below the air quality standard of PM10 that is 150 μg/Nm^3. Based on calculation result, the dust particles caused by processing, crushing, softening, packing and other of organic or inorganic materials, such as stones, wood, metal ores, charcoal, solids and rough-sized materials hovering in the air that is toxic to humans. The content of TSP located in the ambient air generally comes from the combustion process of the perfect fuel either from moving sources or from stationary sources and road dust. TSP content derived from motor vehicle moving source, while the source of particulate emissions from immovable sources comes from settlement. The effects of TSP on human health are fibrosis respiratory disturbances, and lung abstraction. Influence on human health depends on chemical composition, particle size, concentration and long exposure. The impact of particulate dust on the environment such as can reduce visibility/ vision if high concentration, can also cause aesthetic disruption and the closed surface of objects, buildings and others. The TSP content measurement results show that the TSP content were almost the same, 98 μg/ Nm3 and 92 μg/ Nm^3. That was still equal air quality standard 230 μg/ Nm^3). Tabel I show all the measurement results.

Table I. Ambient Air Quality in ITERA

Parameters	Main Gate	Zero point of ITERA
Sulfur dioxide (SO_2)	15 μg/ Nm^3	15 μg/ Nm^3
Nitrogen Dioxide (NO_2)	3 μg/ Nm^3	2 μg/ Nm^3
Ozone (O_3)	5 μg/ Nm^3	2 μg/ Nm^3
Hydrocarbon (HC)	453 μg/ Nm^3	345 μg/ Nm^3
PM10	20 μg/ Nm^3	23 μg/ Nm^3
Dust (TSP)	92 μg/ Nm^3	98 μg/ Nm^3

4. CONCLUSION

Based on the results, it can be concluded that on the day of measurements, the highest concentration of pollutant occurred at the ITERA main gate is hydrocarbon which had the concentration 453 μg/m3. The concentration of all gas at the study site had not exceeded the national ambient air quality standard. Further research is needed to compare the initial state and comply with the Air Pollution Standard Index (ISPU).

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