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Air Pollution Analysis of Preconstruction and Construction Phases in Sumatera Institute of Technology, South Lampung

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The Sumatra Institute of Technology (ITERA) is a state university located in Jati Agung, South Lampung Regency, Lampung Province. Although ITERA has a great potential for campus development in the next 20 years, there are a several challenges that ITERA must be designing. Here, air pollution from gasoline vehicles contributed 70% carbon monoxide (CO), 100% Plumb (Pb), 60% hydro carbon (HC) and 60% nitrogen oxide (NO_X) in south Lampung area by Ministry of Environment (KLH) in 2010. Thus, air quality monitoring has a very important to determine polluted air over measurement location using comparing method based on Air Pollution Standard Index (ISPU). In this study, we identify and analyze pollutant concentrations in Sumatra Institute of Technology's over Pre-construction and Construction Phase and analyze the air pollution using the Ambien Air Quality Standards with ISPU in the Sumatra Institute of Technology. The data observation was conducted in 2017 while continuity of the air quality monitoring series at ITERA by adding more sampling points in 8 months (from March to October 2017). In addition, we use gas parameters from Sulphur dioxide (SO_2), Nitrogen Dioxide (NO_2), Oxidant (O_3), Hydrocarbons (HC), PM10, Dust (TSP) which is refers to PP RI No.41 1999 concerning National Ambient Air Quality Standards.

Keywords: Air Pollution, Monitoring, ITERA

1. INTRODUCTION

The Sumatra Institute of Technology (ITERA) is a state university located in Jati Agung, South Lampung Regency, Lampung Province (Minister of Education and Culture Decree No, 060 / P / 2012). Based on the assignment from the Ministry of Education and Culture, the initial stages of development and implementation will be carried out by the Bandung Institute of Technology in collaboration with the Regional Government of Sumatra [1]. Furthermore, the development of ITERA was strengthened by Presidential Regulation Number 124 Year 2014 concerning the Establishment of the Sumatra Institute of Technology (State Gazette of the Republic of Indonesia Number 253 2014) which was set on October 6, 2014 and promulgated on October 9, 2014, the Sumatra Institute of Technology (ITERA) was established [2].

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Although ITERA has great potential for development in the next 20 years, there are several challenges for ITERA. One of them is pollution both water, air and soil pollution. Air pollution is the presence of undesirable materials in the air, with a number large enough to allow harmful health effects [3]. Along with the high level of mobilization and the need for easy, cheap and safe transportation facilities, the level of use of motorized vehicles will also increase [4]. This is clearly closely related to air pollution due to air pollution can be occur everywhere whether it comes from immovable sources such as industrial activities, natural or other processes and moving sources namely motor vehicle emissions. Data from the Ministry of Environment (KLH) in 2010 mention air pollution from gasoline motor vehicles contributing 70% carbon monoxide (CO), 100% Plumbum (Pb), 60% hydro carbon (HC) and 60%

nitrogen oxides (NOX) [5]. Even some areas with high traffic density show that pollutants such as Pb, ozone (O), and CO exceed the specified threshold with the high level of use of motorized vehicles, there is no exception to public transportation both outside and within the province of urban transport routes within the province, city transportation and transportation with a ratio of the number of fleets to 29% of types of public vehicles and 71% of private vehicles, the number of passengers will be straight with a large number vehicles [6]. Thus, the use of motorized vehicles in the terminal area will also increase the air pollution. Therefore, air quality improvement measures can be carried out by controlling pollutant emissions that enter the air, and thus human activity can continue as expected.

2. METHODOLOGY

Tools and materials used in air quality research are Air Quality Laboratory, 6 (seven) sensor components, namely Sulfur dioxide (SO_2), Nitrogen Dioxide (NO_2), Carbon monoxide (CO_3), Lead (Pb), Dust (TSP), Hydrocarbons (HC); impinger, HVAS, barometer, anemometer, data recording device for recording sensor readings data; Spectrometer, and Stopwatch to find out the measurement time with camera for documentation at the time of the research. Here, data Collection from Measurement in the level of air quality is done by 1 time at each measurement point. In this study, was conducted on weekdays with 3 test point area. Thus, the measurements were collected when conducting an Environmental Impact Analysis at ITERA namely (a) building F (b) Intersection of B and C building ITERA and (c) ITERA Main Road Section (road side).

In this study, one test point is represents area with a high concentration of pollution and this area is carried out for 2 hours each test point. The measurement process is carried out by placing the instrument observation every 5 minute to produce the data observation. In the research, we used interval time can be adjusted according to observation needs. This tool can be read data at intervals of every second, minute, to hourly. In addition, the time interval does not affect the results because it will be estimated in accordance with the actual measurement time. In this study, we took a time interval of 5 minutes for each data to obtain fluctuations in reading data for 1 hour. The observation data is generated to analyze using Research and Standardization Industry Bandar Lampung framework in the laboratory which is the main target in this study.

3. RESULT AND DISCUSSION

Air quality tests are carried out using in the BARISTAN air quality laboratory. In the last a few months, the researcher's progress has been a survey of air quality testing point locations and consultation with Research and Standardization Industry Bandar Lampung (see Table I).

Table I. Ambient Air Quality Analysis Results

		Results				
No.	Parameter	Construction Location	Building Junction	ITERA Gate	Quality Standard	Regulation
1	Sulfur dioxide (SO_2)	15µg/Nm^3	15 µg/Nm^3	15 µg/Nm^3	900µg/Nm^3	PP RI No. 41/ 1999
2	Hydrocarbon (HC)	10 µg/Nm^3	10 µg/Nm^3	11 µg/Nm^3	30000µg/Nm^3	
3	Nitrogen dioxide (NO_2)	9.1 µg/Nm^3	5.6 µg/Nm^3	4.8 µg/Nm^3	400µg/Nm^3	
4	(Pb)	0.8 µg/Nm^3	0.8 µg/Nm^3	0.8 µg/Nm^3	2 µg/Nm^3	
5	Dust (TSP)	1 µg/Nm^3	3 µg/Nm^3	4 µg/Nm^3	230µg/Nm^3	
6	Carbon Monoxide (CO)	653 µg/Nm^3	786 µg/Nm^3	803 µg/Nm^3	30.000 µg/Nm^3	

A. Sulfur Dioxide (SO_2)

Pollution by sulfur oxides is mainly caused by two colorless gas components, namely sulfur dioxide (SO_2) and sulfur trioxide (SO_3) and both are called SO_x. Sulfur dioxide has a characteristic odor that is sharp and does not burn in the air, while sulfur trioxide is an unreactive component. Combustion of 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 oxygen available. The presence of SO_3 in the form of gas is influenced by the amount of oxygen available. The presence of SO_3 in gaseous form is only possible if the concentration of water vapor is very low. If there is sufficient amount of water vapor as usual, SO_3 and water will immediately combine to form sulfuric acid (H_2SO_4) with the following reaction: $SO_3 + H_2O \rightarrow H_2SO_4$, therefore the normal components found in the atmosphere are not SO_2 but H_2SO_4. The effect of SO_x on plants can be influenced by two factors: the effect of SO_2 concentration and contact time. Damage to plant tissue occurs when direct contact with SO_2 at high concentrations in a short time, with symptoms of some parts of the leaf becoming dry and dead, and usually the color is loading. Prolonged contact with SO_2 at low concentrations causes chronic damage, which is characterized by yellowing of the leaf color due to inhibition of the mechanism of formation of chlorophyll. Acute damage to plants is due to the ability of plants to convert SO_2 absorbed through the roots, and if accumulation is high enough, chronic symptoms occur with leaf loss. Effect on humans and animals, SO_x at concentrations far higher than the concentration needed is an irritation of the respiratory system. Some research shows that throat irritation occurs at concentrations 1-2 ppm. SO_2 is considered a pollutant that is hazardous to health, especially for the elderly and sufferers who experience chronic diseases of the respiratory and cardiovascular system-individuals with these symptoms are very sensitive to contact with SO_2, although with relative concentrations low, for example 0.2 ppm or more. SO_2 measurement results at 3 location points still meet the specified quality standards, namely at the point at the construction site, the main gate of ITERA and ITERA intersection have the same value that is less than 15 µg / Nm3 and for the moment there is no visible effect on the

environment such as spotted leaves and yellowing, excessive corrosivity of equipment, or interference with breathing and sore eyes.

B. Nitrogen Doxide (NO_2)

Nitrogen oxide (NO_x) is a group of gases found in the atmosphere consisting of nitrogen oxides (NO) and nitrogen dioxide (NO_2). In fact, other forms of nitrogen oxide still exist, but these two gases are most commonly found as air pollutants. Nitrogen oxide is a colorless and odorless branch, preferably nitrogen dioxide has a reddish-brown color and has a sharp odor. The amount of NO_x in the air in equilibrium is affected by temperature combustion, which at high temperatures will dissociate back to N_2 and O_2, if the mixture temperature decreases slowly it will give enough time for NO to dissociate. Some of the adverse effects caused by NO_x pollution are not caused by these oxides, but because of their role in the formation of photochemical oxygen which is a dangerous component in smoke. The presence of NO_x in the atmosphere at high concentrations of 3.5 ppm occurs necrosis or damage to leaf weaving [6]. NO_2 at a concentration of 5 ppm inhaled for 10 minutes by humans will cause a little difficulty in breathing. The NO_2 content in the air comes from the combustion of nitrogen gas. The measurement result of NO_2 at the construction site is 9.1 µg / Nm^3, the ITERA crossing is 5.6 µg / Nm^3 and the location of the ITERA gate is 4.8 µg / Nm^3 which still meets the specified quality standards.

C. Hydro Carbon (HC)

As an air pollutant, hydrocarbons can come from industrial processes emitted into the air and then are a photochemical source of ozone. HC is the primary pollutant because it is released into the ambient air directly, while the photo oxidant is a secondary pollutant produced in the atmosphere from the results of reactions involving primary pollutants. Industrial activities that have the potential to cause contamination in the form of HC are plastics, resins, pigments, dyes, pesticides and rubber processing. It is estimated that 10% of industry emissions are in the form of HC. HC sources can also come from transportation facilities. Poor machine condition will produce HC. In general, in the morning HC levels in the air are high, but during the day it decreases. In the evening HC levels will increase and then decrease again at night. The presence of hydrocarbons in the air, especially methane, can come from natural sources, especially the biological processes of geothermal activities such as the exploration and utilization of natural gas and petroleum and so on. A fairly large amount also comes from the process of decomposition of organic matter at the soil surface. Likewise, garbage disposal, forest fires and other human activities have a significant role in producing hydrocarbon gas in atmosphere. Hydrocarbons in the air will react with other materials and will form new bonds called polycyclic aromatic hydrocarbons (PAHs) which are often found in industrial areas and in dense traffic. When this PAH enters the lungs will cause injury and stimulate the formation of cancer cells. The results of Hydro Carbon analysis at the construction site are 10 µg / Nm^3, the ITERA crossing is 10 µg / Nm^3 and the location of the ITERA gate is 11 µg / Nm^3. The results of the analysis still meet the quality standards set based on PP 3 RI No. 41 of 1999, the quality standard for hydro carbon is 3000 µg / Nm.

D. Dust (TSP)

Dust particulates are particles caused by the processing, crushing, softening, packing, etc. of organic or inorganic materials, such as stone, wood, metal ores, charcoal, grains of solid substances and coarse-sized materials which are hovering in the air that is toxic to humans. The TSP content in ambient air generally comes from the combustion process of perfect fuel both from moving sources and from immovable sources and road dust. The TSP content originates from a movable source which is a motorized vehicle, while particulate emission sources originating from immovable sources come from settlements. The impact caused by the TSP content on human health is in the form of respiratory disorders such as fibrosis, and lung abstraction. Effects on human health depend on chemical composition, particle size, concentration and duration of exposure. The impact of dust particulates on the environment can reduce visibility / vision if the concentration is high, can also cause aesthetic disturbances and the surface covering of objects, buildings and others. TSP content measurement results show that the TSP content at the construction site is 1 µg / Nm^3, the ITERA crossing is 3 µg / Nm^3 and the location of the ITERA gate is 4 µg / Nm^3 and still meets the specified quality standards.

E. Plumb (Pb)

The influence of Pb particles into the air can be in the form of gas or particles as a byproduct of incomplete combustion in motor vehicle engines. The less complete the combustion process in a motor vehicle engine, the Pb will be emitted into the air. PbO is a compound that is hazardous to health, so the number of lead measurements (Pb) shows that the content at the construction site is 0.8 µg / Nm3, the ITERA crossing is 0.8 µg / Nm^3 and the location of the ITERA gate is 0.8 µg / Nm^3.

F. Carbon monoxide (CO)

Carbon monoxide, the chemical formula CO is a colorless, odorless and tasteless gas. It consists of one carbon atom which is covalently bonded to one oxygen atom. In this bond, there are two covalent bonds and one coordinating covalent bond between carbon and oxygen atoms. Carbon monoxide is produced from incomplete combustion of carbon compounds, often occurring in internal combustion engines. Carbon monoxide is formed when there is a lack of oxygen in the combustion process. Carbon monoxide is flammable and produces a blue flame, producing carbon dioxide. Although it is toxic, CO plays an important role in

modern technology, which is a precursor of many carbon compounds. The results of the measurement of lead content (Pb) showed that the content at the construction site was 653 µg / Nm^3, the ITERA crossing was 786 µg / Nm^3 and the location of the ITERA gate was 803 µg / Nm^3

4. CONCLUSION

Based on the results of the analysis and discussion of air quality monitoring at the Sumatra Institute of Technology due to traffic on the road and the construction of a project, it can be concluded that The day of measurement, the highest pollutant concentration occurred at the main gate of ITERA, namely carbon monoxide concentration of 803 µg / m3 also the concentration of all gases at the study site has not exceeded the national ambient air quality standard.

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