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AIR QUALITY ANALYSIS BASED ON AIR POLLUTION STANDARD INDEX (ISPU) AT CIREBON COAL UNLOADING PORT

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Abstract

Poor air quality can cause various negative impacts. Air pollution kills 7 million people every year, or one in eight premature deaths each year. This problem makes it the biggest environmental health risk in the world. Urban and rural air pollution in Southeast Asia is double the WHO standard, 40% of the population is polluted by household solid fuels. Diseases caused by air pollution 424,000 deaths in Southeast Asia. One of the places with vehicle activities that have a high risk of air pollution is one of the ports. The purpose of this study was to determine the air quality based on the Air Pollution Standards Index (ISPU) at Cirebon Port in 2022. This type of research used quantitative methods categorized in time series research. The subject of this research is the ambient air in Cirebon Port. Samples were taken using a portable gas detector with a sample size of 30 times the measurement time. The data collection technique is using tools and data analysis using one sample t test and one way ANOVA. Univariate analysis of PM10 parameters obtained the highest average results during the day, namely 130.6 g/Nm^3, CO parameters obtained the highest average results during the day, namely 1627.6 g/Nm^3, NO2 parameters obtained the highest average results during the day, namely 130.3 g $/Nm^3$, the highest average yield of SO2 parameter during the day is 53.3 g/Nm^3. The results of the one sample t test show that Ho is rejected and Ha is accepted. The results of the average measurement of the levels of Particulate (PM10), Carbon Monoxide (CO), Nitrogen Dioxide (NO2), Sulfur Dioxide (SO2) are not the same as the quality standard of the Air Pollution Standard Index (ISPU) that has been set.

Keywords: Air Quality, Pollution, ISPU, Port

INTRODUCTION

Poor air quality can cause various negative impacts. Air pollution kills 7 million people every year, or one in eight premature deaths each year. This problem makes it the biggest environmental health risk in the world. Urban and rural air pollution in Southeast Asia is double the WHO standard, 40% of the population is polluted by household solid fuels. Diseases caused by air pollution 424,000 deaths in Southeast Asia. One of the places with vehicle activities that have a high risk of

air pollution is one of the ports. The purpose of this study was to determine the air quality based on the Air Pollution Standards Index (ISPU) at Cirebon Port in 2022. This type of research used quantitative methods categorized in time series research. The subject of this research is the ambient air in Cirebon Port. Samples were taken using a portable gas detector with a sample size of 30 times the measurement time. The data collection technique is using tools and data analysis using one sample t test and one way ANOVA. Univariate analysis of PM10 parameters obtained the highest average results during the day, namely 130.6 g/Nm^3, CO parameters obtained the highest average results during the day, namely 1627.6 g/Nm^3, NO2 parameters obtained the highest average results during the day, namely 130.3 g /Nm^3, the highest average yield of SO2 parameter during the day is 53.3 g/Nm^3. The results of the one sample t test show that Ho is rejected and Ha is accepted. The results of the average measurement of the levels of Particulate (PM10), Carbon Monoxide (CO), Nitrogen Dioxide (NO2), Sulfur Dioxide (SO2) are not the same as the quality standard of the Air Pollution Standard Index (ISPU) that has been set.

RESEARCH METHODS

This type of research uses quantitative methods which are categorized as time series research. This research uses a portable gas detector. Sampling using a tool at 30 times the time of collection. The purpose of this analysis is to conduct air measurements based on the Air Pollution Standard Index (ISPU) by observing and collecting data at a certain time. Measurements were carried out to determine a variable and compared with the quality standard based on the Regulation of the Minister of the Environment in 2010.

The data analysis used is univariate and bivariate analysis. The bivariate analysis in this study was to determine the comparison of the average results of air quality analysis with the Air Quality Standard Index (ISPU) at the Port of Cirebon. The sample is 30 times the time of collection. The data collection technique used in this study is to directly measure the air quality in the affected field. The data needed to support air quality is direct data from research subjects using a Portable Gas Detector and observation. Air quality will be measured at 08:00 – 10:00 WIB in the morning, at 01:00 – 02:00 WIB in the afternoon and at 04:00 – 05:00 WIB in the afternoon based on SNI 19-7119.6-2005 .

RESULT AND DISCUSSION

Based on the results of statistical tests for PM10 parameters, the highest average results were obtained during the day, namely 130.6 g/Nm^3, CO parameters obtained the highest average results during the day, namely 1627.6 g/Nm^3, NO2 parameters obtained the highest average results during the day, namely 130, 3 g/Nm^3, the highest average yield of SO2 parameter during the day is 53.3 g/Nm^3. "The results of the average measurement of the levels of Particulates (PM10), Carbon Monoxide (CO), Nitrogen Dioxide (NO2), Sulfur Dioxide (SO2) are not the same as the quality standards of the Air Pollution Standard Index (ISPU) that have been set".

Univariate Test Results

Univariate analysis was used to determine the distribution of frequencies andpercentages in each sample studied. The results of the study on the description of the levels of PM 10, CO, NO2, SO2 with 30 times of sampling time for each level at the Port of Cirebon in 2022 which was carried out in a data collection format, then the data was calculated in the form of frequency distribution and percentage presented in the form of a table as follows:

Table 1 Univariate Analysis

Time	N	Min	Max	Average	S. Deviation
PM 10					
Morning	10	85	114	94	8,524
Afternoon	10	98	162	130,6	21,920
Afternoon	10	78	144	115,4	24,686
CO					
Morning	10	665	1901	1202,1	449,464
Afternoon	10	593	3789	1627,6	953,780
Afternoon	10	540	2098	1141,3	533,802
NO_2					
Morning	10	67	94	79.7	9,019
Afternoon	10	84	180	130,3	35,926
Afternoon	10	45	78	64,1	11,090
SO_2					
Morning	10	35	67	46,8	9,307
Afternoon	10	40	70	53,3	11,991
Afternoon	10	37	68	46,6	9,395

Source: Research Results in 2022

Based on table 1, it is known that the PM10 parameter has the highest average yield during the day, namely 130.6 g/Nm³, the CO parameter has the highest average result during the day, which is 1627.6 g/Nm³, and the NO2 parameter has the highest average result during the day, which is 130 ,3 g/Nm³, the highest average yield SO2 parameter during the day is 53.3 g/aNm³.

Table 2 Analysis of Measurement Levels with Air Pollution Standard Index (ISPU)

Parameter	N	t	df	Average	Difference Average	P Value (95% CI)
				Test Value = 150		
PM10	30	-8,774	29	113,33	-38,000	0,000 ((-46,86)-(-29,14))
				Test Value = 30000		
CO	30	-226,3	29	1323,67	-28676	0,000 ((-28935,54)-(-28417,13))
				Test Value = 400		
NO_2	3	-46,69	29	91,37	-308,3	0,000 ((-321,8)-(-

	0					294,8))
			Test Value = 900			
SO_2	30	-446,6	29	1323,67	-851,1	0,000 ((-855)-(-847,2))

Based on table 2, it is known that the t-count value for PM10 is -8.774 with 29 degrees of freedom and p-value is 0.000, the t-count CO value is -226.3 with 29 degrees of freedom and p-value is 0.000, t-counted NO2 is -226,3 with 29 degrees of freedom. and the p value is 0.000, the t value is SO2 -446.6 with 29 degrees of freedom and the p value is 0.000. It can be concluded that the results of the average measurement of the levels of Particulate (PM10), Carbon Monoxide (CO), Nitrogen Dioxide (NO2), Sulfur Dioxide (SO2) are not the same as the quality standard of the Air Pollution Standard Index (ISPU) that has been set. The use of tables and figures should be mentioned in the text by mentioning table 1; Figure 1 and so on.

An overview of the trend of particulate levels (PM10) in the Cirebon Port Area in 2022

According to the Indonesian Ministry of Health (2018), most of human activities such as dust, dust is a particulate group from the breakdown of a material with a size of 0.1 – 25μm. There are three types of dust particles, namely organic, metal and mineral dust, this dust can also be called smoke/soot which is very dangerous as an air pollutant that can penetrate the lungs.

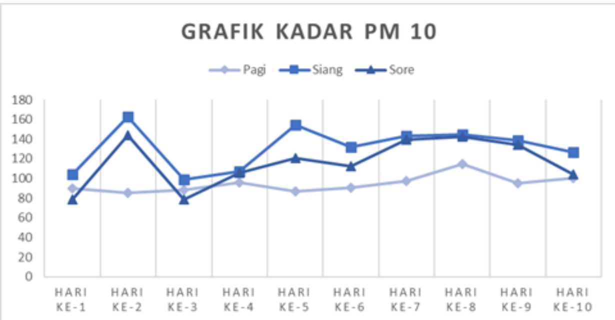

Figure 1. Graph of PM10 . levels

Based on the data obtained during the measurement of the highest PM 10 concentration during the day on the second day of 162.7 g/Nm3, it already passed the ambient air quality standard based on PP RI NO 41 of 1999 which was 150 g/Nm3 where during the day there was an increase in vehicles. Those who want to transport coal and also activities at the port during the day are very crowded.

An overview of the trend of Carbon Monoxide (CO) levels in the Cirebon Port Area in 2022

One of the toxic gases is carbon monoxide which is produced when fuels (kerosene, oil, coal, petroleum gas, and wood) are burned. No color, no smell and no taste which makes it very difficult to detect. The distribution of carbon monoxide in the city and in the suburbs is different. In the city it is very dense with vehicles and industry so it is polluted with carbon monoxide in the air, while in the suburbs it is relatively small (Kemenkes, RI, 2018). Carbon Monoxide is said to kill silently because of its physical properties that have no taste, no color, no smell, and cause death due to exposure to high concentrations (Retno, 2018). The resulting damage can cause tissue hypoxia and interfere with respiration (Carrer et al, 2015).

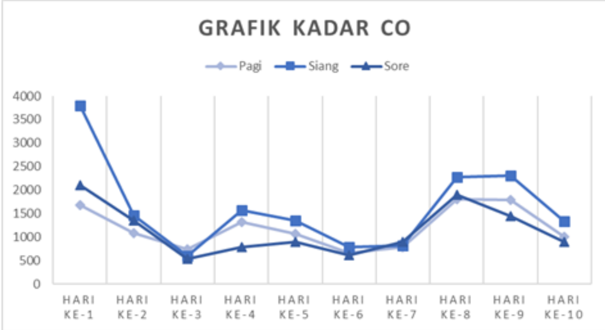

Figure 2. Graph of CO . levels

Based on the data obtained during the measurement of the highest CO concentration during the day on the first day of 3789.67 g/Nm3 although the value of CO concentration is still below the ambient air quality standard based on PP RI NO 41 of 1999, which is 30,000 g/Nm3 where during the day there is an increase in vehicles that want to transport coal. Recently, the issue of climate change has attracted the attention of environmental experts to prove this. One of the factors causing climate change is the increase in CO (carbon monoxide) in the atmosphere. If it continues until 2050, CO is predicted to reach 600 ppm, resulting in global climate change.

The highest measurement of Carbon Monoxide (CO) occurs during the day, this is due to the large number of transportation activities, especially heavy vehicles passing by to transport coal. The IEA report (2016) states that the transportation sector contributes 20% of the world's emissions. Reducing emissions generated from the transportation sector is very difficult, even more difficult than reducing emissions from the electricity sector, because the transportation sector is still dependent on the use of fossil fuels.

This research is in line with the research of Muqqorobin (2019), the average value of CO concentration from day 6 to day 8 continues to increase. The highest value of CO concentration occurred during the day. This is because during the day at the Bojonegoro Main Market the main pollutant source of CO producing, namely the number of vehicles has increased so that CO also increases.

An overview of the trend of Nitrogen Dioxide (NO2) levels in the Cirebon Port Area in 2022

A reddish-brown toxic gas that generally occurs as an air pollutant, formed by the oxidation of nitric oxide or by combustion in the presence of air. Nitrogen dioxide or N02 if it passes through the NAB becomes a pollutant that causes acid rain resulting in damage to buildings, acidity of the soil and others. Nitrogen dioxide also functions as a guide in the formation of ozone which is another air pollutant (Rofienda, 2009).

Based on the data for NO2 measurement results, there is the highest value of NO2 concentration of 180.8 g/Nm3 the concentration is on the 2nd day at noon where at that time many trucks are heating the engine and preparing to transport passengers. As for the results during the measurement, when compared to PP RI NO 41 of 1999, the results show that they are still below the specified quality standard of 400 g/Nm3 even though the results of NO2 concentration are still below the quality standard if exposure continues to occur in the long term, it will increase the potential for harm to health. health.

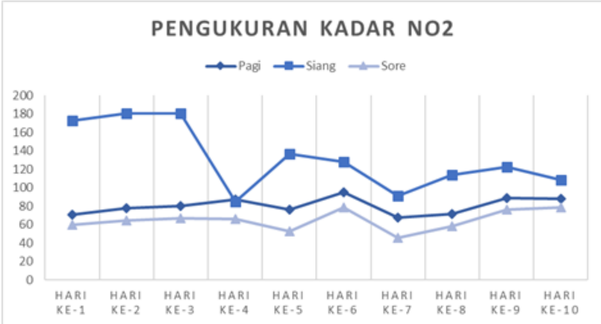

Figure 3. Graph of NO2 . levels

Based on the research table, it can be seen that the results of descriptive analysis obtained the highest average results during the day, namely 130.3 g/Nm³ and a standard deviation of 35.926 with a minimum value of 84 g/Nm³ and a maximum of 180 g/Nm³. While the lowest average result in the afternoon is 64.1 g/Nm³ and a standard deviation of 11.090 with a minimum value of 45 g/Nm³ and a maximum of 78 g/Nm³.

Analysis of Average Patriculate Levels (PM10) with Quality Standards of Air Standard Index (ISPU) and Time Comparison

The results of the one sample t test are known to have a t count of -8.774 with 29 degrees of freedom and a p value of 0.000. When compared with the p value of 0.00 < 0.05 and the value of t count (-8.774) < t table (1.699), then according to the basis of decision making above, it can be concluded that Ho is rejected and Ha is accepted. Thus, it can be interpreted that the value of the average measurement of PM 10 levels is not the same as the quality standard of the Air Pollution Standard Index (ISPU) that has been determined. From the research table with the one-way ANOVA test, it can be concluded that the significant value for the PM10 variable is 0.001 <0.05, which means Ho is rejected and Ha is accepted. This indicates that there is a significant difference between the time of taking the morning and afternoon regarding the measurement of levels of Patriculate (PM10).

Based on the researcher's analysis during the research process and based on the data obtained during the study of measuring levels of Patrikulate (PM10) in the appropriate category, however, the levels of Patrikulate (PM10) were still in the inappropriate category for some time, this is an evaluation for related parties in order to maintain environment in the appropriate category so as not to disturb the respiratory tract. This result is expected to be a reference for the Port Health Office (KKP) and the Environment Service (DLH) to pay more attention to any air quality at the port.

Analysis of Average Carbon Monoxide (CO) with Quality Standards of Air Standard Index (ISPU) and Time Comparison

The results of the one sample t test are known to have a t count of -226.3 with 29 degrees of freedom and a p value of 0.000. When compared with the p value of 0.00 < 0.05 and the value of t arithmetic (-226.3) < t table (1.699), then according to the basis of decision making above, it can be concluded that Ho is rejected and Ha is accepted. Thus, it can be interpreted that the value of the average measurement of CO levels is not the same as the quality standard of the Air Pollution Standard Index (ISPU) that has been determined. The results of this study are not in line with Amirah's (2019) research on air quality analysis for monitoring hospital environmental health. The results of the tests carried out on three conditions, namely the patient's room, the parking area, and the waiting room, got varying results. In the patient's room obtained the best air quality results. While in the parking area get the worst results. In the waiting room area of the hospital, the results obtained are poor CO2 levels. The measurement tool based on the calibration results has an error of 15.11% for the CO sensor and 24.08% for 24.08%. The test results of sending information from the microcontroller to the application show an error of 2.3%.

Based on the researcher's analysis during the research process and based on the data obtained during the study of measuring levels of Carbon Monoxide (CO) in the appropriate category, however, the levels of Carbon Monoxide (CO) must remain in the appropriate category so as not to disturb the respiratory tract. This result is expected to be a reference for the Port Health Office (KKP) and the Envi onment Service (DLH) to pay more attention to any air quality at the port.Analysis of Average Nitrogen Dioxide (NO2) with Air Standard Index (ISPU) quality standards and Time Comparison

The results of the one sample t test are known to have a t count of -226.3 with 29 degrees of freedom and a p value of 0.000. When compared with the p value of 0.00 <0.05 and the value of t arithmetic (-46.69) < t table (1.699), then according to the basis for the decision above, it can be concluded that Ho is rejected and Ha is accepted. Thus, it can be interpreted that the value of the average measurement of NO2 levels is not the same as the quality standard of the Air Pollution Standard Index (ISPU) that has been determined. These differences can be explained through the post-hoc test conducted. It can be seen that there is a significant difference between the time of taking the morning and the time of taking the afternoon, between the time of taking the afternoon and the time of taking the morning, between the time of taking the time of afternoon with the time of taking the afternoon and between the time of taking the time of the afternoon with the time of taking the afternoon. Meanwhile, for the time of taking morning with afternoon and afternoon with morning the differences that occur are not significant. This is because in the morning there is minimal employee activity and the cardinal direction is towards the northeast which is opposite to the research point, while in the afternoon there is a density of activity causing a significant difference.

The results of this study indicate that the results of monitoring the ambient air quality of NO2 and SO2 in the Babelan District Office area from 2018–2020 show that the results are still below the ambient air quality standard. Meanwhile, for the South Cikarang Police, the results of monitoring NO2 and SO2 in 2019 exceeded the quality standard with concentrations of 51 g/m3 and 100 g/m3. Based on the researcher's analysis during the research process and based on the data obtained during the study measuring the levels of Nitrogen Dioxide (NO2) in the appropriate category, however, the levels of Nitrogen Dioxide (NO2) must remain in the appropriate category by paying attention to the loading dock time so as not to disturb the respiratory tract. This result is expected to be a reference for the Port Health Office (KKP) and the Environment Service (DLH) to pay more attention to any air quality at the port.

Analysis of Average Sulfur Dioxide (SO2) with Quality Standards of Air Standard Index (ISPU) and Time Comparison

The results of the one sample t test are known to have a t count of -446.6 with 29 degrees of freedom and a p value of 0.000. When compared with the p value of $0.00 < 0.05$ and the value of t arithmetic (-446.6) < t table (1.699), then according to the basis of the decision above, it can be concluded that Ho is rejected and Ha is accepted. Thus, it can be interpreted that the value of the average measurement of SO2 levels is not the same as the quality standard of the Air Pollution Standard Index (ISPU) that has been determined. Sulfur dioxide (SO2) comes from 2 sources, namely natural and artificial sources, if the natural source comes from volcanoes, decomposition of organic matter by microbes. Sources of SO2 of artificial origin are the burning of oil, gas and coal which contain high sulfur (Ministry of Health of the Republic of Indonesia).

CONCLUSION

Based on the results of the research and discussion described in the previous chapter regarding Air Quality Analysis Based on Air Pollution Standards Index at Cirebon Port in 2022. that the PM10 parameter obtained the highest average result during the day, namely 130.6 g/Nm^3, the CO parameter obtained the highest average result. during the day that is 1627.6 g/Nm^3, the highest average yield of NO2 parameter is 130.3 g/Nm^3 during the day, the highest average yield of SO2 parameter is 53.3 g/Nm^3. The bivariate results showed that the t-count value for PM10 was -8.774 with 29 degrees of freedom and p-value 0.000, CO--226.3 t-count with 29 degrees of freedom and p-value 0.000, t-count NO2 -226,3 with 29 degrees of freedom and p value is 0.000, the t value is SO2 -446.6 with 29 degrees of freedom and p value is 0.000. It can be concluded that the results of the average measurement of the levels of Particulate (PM10), Carbon Monoxide (CO), Nitrogen Dioxide (NO2), Sulfur Dioxide (SO2) are not the same as the quality standard of the Air Pollution Standard Index (ISPU) that has been set.

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