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Ambient Air Quality And Noise Analysis In Office Area: A Descriptive Measurement Study Single Point (Outdoor) In Parepare City

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Abstract

Ambient air quality and environmental noise are important determinants of occupational health, work comfort, and employee productivity, particularly in office environments where daily activities are continuously conducted. Poor ambient air quality and excessive noise exposure may increase the risk of respiratory disorders, fatigue, and reduced work concentration. Therefore, periodic monitoring of air quality parameters in office areas is essential to ensure a healthy working environment. This study aims to analyze the condition of ambient air quality and noise levels in an office area of Parepare City based on physical and chemical air parameters.

This research employed a quantitative descriptive approach using a single-point outdoor measurement method. Data collection was conducted on November 20, 2025. The parameters measured included air temperature, relative humidity, wind speed, sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter (PM_{10}), and noise levels. Measurement instruments consisted of a Sound Level Meter, thermohygrometer, anemometer, and an air quality monitoring device.

The results showed that the measured noise level was 64.46 dB(A), air temperature was 30°C, relative humidity was 76.8%, SO_2 concentration was 262 µg/Nm³, PM_{10} concentration was 28 µg/Nm³, while NO_2 and CO were not detected. All measured air pollutant parameters were below the ambient air quality standards stipulated in South Sulawesi Governor Regulation Number 69 of 2010. However, physical parameters such as temperature and humidity indicated less optimal comfort conditions for office environments. This study provides baseline information on ambient air quality in office areas and may serve as a reference for environmental monitoring and air quality management to support sustainable occupational health.

Keyword: air quality, noise, office environment, physical parameters, air pollution, occupational health

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Introduction

Ambient air quality represents a crucial indicator of environmental health, particularly in office areas that function as centers of daily occupational and community activities. Office environments are continuously exposed to multiple pollution sources, including motorized vehicle emissions, human mobility, building operational activities, and meteorological conditions that influence the dispersion and accumulation of air pollutants. These factors not only affect ambient air quality but also contribute to environmental noise, both of which have direct implications for workers' comfort, health, and productivity. According to the World Health Organization (WHO), ambient air pollution contributes to more than 4.2 million

premature deaths globally each year, emphasizing the importance of systematic air quality monitoring as part of public health protection efforts.

In Indonesia, ambient air quality and environmental noise standards are regulated under South Sulawesi Governor Regulation Number 69 of 2010, which establishes permissible limits for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter (PM_{10}), and noise levels in office areas. Reports from the Ministry of Environment and Forestry (KLHK) indicate an increasing trend in particulate and gaseous pollutant concentrations in urban areas over the past decade, driven by rapid motor vehicle growth and changes in land use patterns. Previous studies have demonstrated that air quality in office areas varies depending on traffic intensity, local meteorological conditions, and spatial planning characteristics. For instance, Pratama (2020) reported that office areas with moderate traffic activity exhibited lower concentrations of SO_2 and PM_{10} compared to industrial zones, suggesting that pollutant levels in office environments are dynamic and require continuous monitoring.

Despite these findings, existing studies predominantly focus on industrial zones, high-traffic corridors, or densely populated residential areas, while investigations related to ambient air quality and noise in relatively low-activity office environments remain limited. This gap indicates a lack of comprehensive evidence regarding environmental conditions in office areas that are generally assumed to be less polluted. Moreover, few studies integrate the assessment of physical parameters (temperature, humidity, wind speed), chemical pollutants, and noise levels within a single measurement framework, even though these variables interact in influencing pollutant behavior and human exposure.

Therefore, this study addresses this research gap by conducting an integrated assessment of ambient air quality and noise levels at a single outdoor measurement point in an office area of Parepare City, incorporating both meteorological and pollutant parameters. The research question guiding this study is: How do ambient air quality and noise levels in office areas comply with the applicable environmental quality standards? Accordingly, this study aims to evaluate ambient air quality and noise conditions in an office environment and to assess their compliance with the quality standards stipulated in South Sulawesi Governor Regulation Number 69 of 2010.

Method

This study employed a descriptive–comparative quantitative design to evaluate ambient air quality and noise levels in an office area of Parepare City. The research approach was based on a comparative framework that contrasts measured environmental parameters with established regulatory standards, as applied in previous ambient air quality studies. The study was conducted at a single outdoor measurement point selected to represent typical environmental exposure conditions in office surroundings.

Data collection was carried out on November 20, 2025, between 09:00 and 12:00 WITA. The study population comprised all ambient air quality parameters present in the office environment, while the sample consisted of physical and chemical air parameter values obtained from one purposively selected measurement point. The purposive sampling technique was applied to capture representative environmental conditions influenced by office activities and potential pollution sources.

Ambient air quality data were collected through direct field measurements using standardized instruments. Noise levels were measured using a Sound Level Meter (Benetech GM1358). Air temperature and relative humidity were recorded using a Digital Thermo-Hygrometer (HTC-2), while wind speed was measured with a Digital Anemometer (Benetech GM816). Particulate matter (PM_{10}) concentration was measured using a YESDUST Particulate Sensor (YES Environment, USA). Sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) were

collected using an impinger method and analyzed with chemical reagents including H_2O_2, Na_2CO_3, and oxidizing solutions (Merck, ≥99%). Carbon monoxide (CO) concentration was measured using a Portable Gas Detector (MultiRAE Lite, RAE Systems).

Data analysis was performed quantitatively by comparing the measured values of SO_2, NO_2, CO, PM_{10}, and noise levels with the ambient air quality standards stipulated in South Sulawesi Governor Regulation Number 69 of 2010. Gas concentration data were converted from parts per million (ppm) to micrograms per normal cubic meter (µg/Nm³) using standard conversion factors at 25°C and 1 atm pressure. The results are presented in tabular form and interpreted descriptively to determine the ambient air quality status at the study location in relation to regulatory thresholds and findings from previous studies.

Results and discussions

Result

Table 1. Results of ambient air quality parameter measurements

Parameter	Results	Unit
Noise	64.46	Db(A)
Temperature	30	℃
Humidity	76.8	%
SO2	262	µg/Nm³
NO2	0	µg/Nm³
CO	0	µg/Nm³
PM10	28	µg/Nm³
Wind Velocity	1.5	m/ss

Based on Table 1, the results of ambient air quality measurements showed that the noise level in the office area was 64.46 dB(A), which is below the permissible threshold. The air temperature was recorded at 30°C, while relative humidity reached 76.8%, indicating typical outdoor environmental conditions. Chemical air quality parameters demonstrated low pollutant concentrations, with sulfur dioxide (SO_2) measured at 262 µg/Nm³ and particulate matter (PM_{10}) at 28 µg/Nm³. Nitrogen dioxide (NO_2) and carbon monoxide (CO) were not detected during the measurement period. The recorded wind speed was 1.5 m/s, which supports pollutant dispersion in the outdoor environment.

Table 2. Comparison of measurement results with the quality book of South Sulawesi Governor Regulation No. 69/2010

Parameter	Results	Quality standards	Status
Noise	64.46 dB(A)	65 dB(A)	Fulfil
SO2	262 µg/Nm³	900 µg/Nm³	Fulfil
NO2	0 µg/Nm³	400 µg/Nm³	Fulfil
CO	0 µg/Nm³	30,000 µg/Nm³	Fulfil
PM10	28 µg/Nm³	50 µg/Nm³	Fulfil
Temperature	30 °C	-	Not rated
Humidity	76.8%	-	Not rated

Furthermore, Table 2 presents a comparison between the measurement results and the ambient air quality standards stipulated in South Sulawesi Governor Regulation Number 69 of

2010. The noise level of 64.46 dB(A) met the allowable limit of 65 dB(A). The SO_2 concentration of 262 µg/Nm³ was substantially lower than the standard value of 900 µg/Nm³, while PM_{10} concentration (28 µg/Nm³) was also below the permissible limit of 50 µg/Nm³. NO_2 and CO concentrations were recorded at 0 µg/Nm³, which are far below their respective quality standards. Physical parameters such as temperature and humidity were not assessed against specific regulatory thresholds; therefore, they were categorized as not evaluated.

Overall, these findings indicate that all measured ambient air pollutant parameters complied with the applicable quality standards. Consequently, the ambient air quality at the sampling location can be classified as safe and does not pose a health risk to individuals in the office environment.

Discusion

The results of ambient air quality and noise measurements in the office area of Parepare City indicate that all observed parameters were within the permissible limits established by South Sulawesi Governor Regulation Number 69 of 2010. These findings reflect favorable environmental conditions and support the research objective of assessing compliance with ambient air quality standards.

Noise Level

The measured noise level was 64.46 dB(A), which is slightly below the allowable limit of 65 dB(A) for office areas. This result indicates that environmental noise at the study location has not reached a level that may cause discomfort or adverse health effects. Scientifically, noise levels in office environments are influenced by human activity, vehicular traffic, building structures, and meteorological conditions. The observed value suggests that noise sources were primarily derived from light traffic and routine office activities. This finding is consistent with Rahmawati (2021), who reported noise levels ranging from 63–68 dB(A) in office areas in Makassar, confirming that office environments generally exhibit stable noise patterns with minor temporal variations.

Air Temperature

The recorded air temperature of 30°C represents typical outdoor thermal conditions for office areas located in coastal regions. Temperature is affected by solar radiation intensity, vegetation coverage, and anthropogenic activities. Although no specific regulatory threshold exists for ambient air temperature, this parameter plays a significant role in influencing pollutant dispersion. Previous studies have shown that higher temperatures enhance vertical air movement, thereby reducing pollutant accumulation. Yulidar (2020) reported that temperatures exceeding 28°C promote pollutant dispersion, which aligns with the low concentrations of gaseous pollutants observed in this study.

Relative Humidity

The relative humidity level of 76.8% reflects humid atmospheric conditions characteristic of coastal areas in South Sulawesi. High humidity affects atmospheric chemistry by facilitating wet deposition and accelerating particulate settling. Scientifically, elevated humidity reduces the persistence of gaseous pollutants such as SO_2 and NO_2 by enhancing chemical transformation and deposition processes. Mustafa (2019) reported that humidity levels above 70% significantly increase particulate deposition rates, supporting the low concentrations of PM_{10}, NO_2, and CO observed in this study.

SO_2 Concentration

The measured SO_2 concentration was 262 µg/Nm³, substantially lower than the regulatory limit of 900 µg/Nm³. This result suggests minimal sulfur emission sources in the

office area, likely due to moderate vehicular activity and the absence of industrial combustion processes. Additionally, wind speed of 1.5 m/s and high humidity conditions likely enhanced atmospheric dispersion and chemical transformation of SO_2. This finding is consistent with Pratama (2020), who reported SO_2 concentrations ranging from 150–350 µg/Nm³ in urban office areas with moderate activity levels.

NO_2 Concentration

NO_2 concentration was recorded at 0 µg/Nm³, far below the permissible limit of 400 µg/Nm³. This may be attributed to low combustion intensity and favorable meteorological conditions that facilitate rapid dispersion and photochemical degradation of NO_2. NO_2 is highly reactive and readily undergoes oxidation and photolysis under sunlight exposure. Similar findings were reported by Sihaloho (2018), who observed negligible NO_2 concentrations in areas with low traffic density.

CO Concentration

The CO concentration was not detected during the measurement period, indicating values well below the standard limit of 30,000 µg/Nm³. Carbon monoxide typically originates from incomplete combustion processes; therefore, its absence suggests minimal combustion-related activities in the surrounding environment. Furthermore, CO is easily dispersed in open outdoor conditions, particularly with sufficient wind movement. Wulandari (2021) reported that CO concentrations in office areas with low traffic intensity often fall below instrument detection limits, supporting the results of this study.

PM_{10} Concentration

The PM_{10} concentration of 28 µg/Nm³ was below the regulatory threshold of 50 µg/Nm³, indicating that suspended particulate levels were within a safe range. PM_{10} concentrations are influenced by road dust, human activity, wind speed, and humidity. High humidity enhances particulate hygroscopicity, causing particles to aggregate and settle more rapidly. Amran (2022) reported PM_{10} concentrations ranging from 20–40 µg/Nm³ in urban office environments, which is consistent with the findings of this study.

Conclusion

This study concludes that ambient air quality in the office area of Parepare City was in good condition, as all measured physical and chemical parameters—including noise, temperature, humidity, SO_2, NO_2, CO, and PM_{10}—were below the quality standards stipulated in South Sulawesi Governor Regulation Number 69 of 2010. These findings confirm the research objective and support the hypothesis that office environments with moderate activity levels do not generate significant environmental pollution.

Meteorological factors, particularly air temperature (30°C), relative humidity (76.8%), and wind speed (1.5 m/s), played an important role in maintaining low pollutant concentrations. These conditions facilitated pollutant dispersion, deposition, and chemical degradation processes, especially for gaseous pollutants such as SO_2, NO_2, and CO, thereby contributing to a safe ambient air environment.

The relatively low concentrations of PM_{10} and SO_2 indicate that emission sources related to human activities in the office area were minimal and that local environmental conditions supported effective particulate settling. This finding reinforces the conclusion that office areas with low traffic intensity tend to exhibit stable ambient air quality and pose a low risk to occupational health.

Despite all parameters meeting regulatory standards, routine monitoring of ambient air quality in office environments remains essential as a preventive measure. Future studies are

recommended to conduct long-term and multi-point measurements, incorporate seasonal variation analysis, and assess indoor air quality to provide a more comprehensive understanding of environmental exposure and support sustainable environmental management in office areas

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