Nigerian Journal of Applied Physics (NJAP)
ISSN Print: 3115-5871
ISSN Online: 3115-588X
DOI: https://doi.org/10.62292/njap-v2i4-2026-109
Volume 2(4), December 2026

Assessment of Environmental Noise Levels in Kpansia Market, Yenagoa, Nigeria

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ABSTRACT

Environmental noise pollution has become a major public health concern in urban commercial centers owing to increasing human activities and mechanized operations. This study assessed environmental noise exposure in Kpansia Market, Yenagoa, Bayelsa State, Nigeria, using the Equivalent Sound Level (L_{eq}) approach. Noise measurements were conducted at 21 strategic locations within the market. Measurements were obtained using a TES 1350A digital sound level meter (IEC 61672-1 Class 2) with A/C frequency weighting and fast/slow time weighting for 20 s at each point. The measured noise levels ranged from 65.2 dB(A) in the Bedspread section to 94.6 dB(A) in the Grinding Machine section. The overall equivalent continuous noise level (L_{eq}) for the market was calculated to be 82.68 dB(A). This value exceeds the recommended daytime limit of 70 dB(A) for commercial areas, indicating significant environmental noise pollution within the market. The Grinding Machine area presented the highest risk, exceeding 90 dB(A). The findings suggest that traders and visitors may be exposed to potentially harmful noise levels, particularly in areas where mechanical equipment is in operation. Comparing with other Nigerian markets shows that the Kpansia Market experiences typical urban market noise exposure in Nigeria. Therefore, the implementation of noise control measures to reduce exposure and improve environmental quality within the market is recommended.

Keywords: Environmental noise, Equivalent continuous noise level (L_{eq}), Noise pollution, Kpansia Market, Bayelsa State.

INTRODUCTION

Noise pollution, also known as environmental noise or sound pollution, refers to excessive or unwanted sounds that disrupt the normal acoustic environment and adversely affect human health and well-being (Alam et al., 2024; Karki et al., 2024; Aletta, 2025). Noise is generally defined as any unwanted or undesirable sound whose perception depends on the listener, location, and time of occurrence. A sound that is considered useful in one situation may be regarded as a noise in another. With rapid urbanization and increasing commercial activities, environmental noise has become one of the most widespread forms of pollution, particularly in developing countries, where regulations are often inadequately enforced. Urban markets are a major source of environmental noise because they serve as centers for commercial, social, and economic activities. The continuous interaction between traders, customers, transport operators, and service providers creates a noisy environment characterized by shouting, the use of loudspeakers for advertisements, vehicle movement, power generators, grinding machines, and other mechanical equipment. In Nigeria, where the public electricity supply is often unreliable, the widespread use of portable generators further contributes to elevated environmental noise levels in markets (Osisanya *et al.,* 2022). The combination of these activities results in fluctuating and sometimes excessive noise levels that may exceed the recommended environmental standards. Environmental noise has been recognized as a significant public health concern because of its adverse effects on both auditory and nonauditory health. Unlike many environmental pollutants that enter the body through inhalation or ingestion, noise affects humans through auditory perception and physiological stress (Brown & Kamp, 2017). Prolonged exposure to high noise levels may result in hearing impairment, tinnitus, sleep disturbance, increased blood pressure, cardiovascular diseases, reduced concentration, impaired communication, psychological stress, decreased

productivity, and a decline in the overall quality of life (Olukanni *et al.,* 2022; Najmaldin, 2025). Medical evidence indicates that continuous exposure to sound levels above 85 dB(A) which is the occupational exposure threshold, particularly for several hours daily, may cause permanent hearing damage (Chaudhary & Chaudhary, 2020; Kanu, 2025). The increasing burden of noise pollution has prompted international and national organizations to establish permissible environmental noise limits. The World Health Organization (WHO) recommends daytime noise limits of 65 dB(A) and nighttime limits of 55 dB(A) for commercial areas, whereas lower limits are recommended for residential and silent zones (Ogobiri *et al.,* 2022). Similarly, the National Environmental Standards and Regulations Enforcement Agency (NESREA) prescribe a maximum daytime noise level of 70 dB(A) for commercial areas in Nigeria (Ogobiri *et al.,* 2022). Despite these guidelines, noise levels in many Nigerian markets are suspected to exceed these limits because of increasing commercial activities, transportation, and extensive use of fuel-powered machines. The Kpansia Market in Yenagoa, Bayelsa State, is a rapidly growing urban market where commercial activities take place throughout the day. The market accommodates numerous trading sections and attracts a large number of traders, buyers, transport operators, and artisans. Daily activities involving grinding machines, power generators, vehicular traffic, loud conversations, and public address systems contribute to elevated environmental noise levels. Continuous exposure to such conditions may pose health risks to traders, workers, and customers who spend several hours within the market environment. Although several studies have assessed environmental noise in different Nigerian cities, there is limited information on the spatial distribution of noise levels and the extent of noise pollution within the Kpansia Market. Reliable information on noise exposure patterns is necessary for evaluating compliance with established standards and developing appropriate environmental management strategies. Such information is also valuable for creating awareness among traders and policymakers of the potential health consequences of prolonged noise exposure. Against this background, this study assessed the environmental noise levels in selected sections of the Kpansia Market in Yenagoa, Bayelsa State. Specifically, the study determined the continuous equivalent noise level (Leq) and Noise Pollution Level (LNP) across different locations within the market and compared the measured values with the established WHO and NESREA permissible limits. The findings are expected to provide baseline data for environmental monitoring and contribute to policies aimed at protecting public health and improving environmental quality in the market.

MATERIALS AND METHODS

Study Area

The study was conducted at the Kpansia market, located in Yenagoa, the capital of Bayelsa State, Nigeria. It is a vibrant and bustling hub of economic activity. As one of the city's central market places, it serves thousands of people daily, offering a wide variety of goods and services, from fresh products to clothing and household items to food. Similar to many open markets in Nigeria. The Kpansia market is characterized by a distinctive soundscape, with the constant hum of human voices, blowing of car horns, and the occasional burst of loud music. This creates a complex auditory environment that can be both energizing and overwhelming for visitors and workers (Makwe *et al*., 2024). The Kpansia market is one of Yenagoa's key commercial areas, serving not only the residents of the city but also traders and visitors from the surrounding communities. The market has grown steadily over the years and has become a significant part of the local economy. Similar to many Nigerian markets, Kpansia operates in an open-air setting with a variety of stalls, sheds, and temporary structures that house vendors selling everything from fruits and vegetables to clothing, electronics, and household items.

Measurement Procedure

Measurements were taken using a TES 1350A digital sound level meter (TES Electrical Electronic Corp.) compliant with IEC 61672-1 Class 2. It determines sound levels in decibels (dB), allowing users to accurately measure noise levels in any given area. The digital sound level meter is designed to measure the sound level requirements of safety engineers, health, and quality control in various environments. The meter has selectable ranges of Low 35–100 dB and High 65–130 dB, A and C frequency weighting, and Fast/Slow time weighting. The calibration was performed at 94 dB using the built-in CAL function (TES Electrical Electronic Corp., 2005). A-weighting and Slow response were used for all measurements to capture the steady-state market noise. At each of the 21 locations, the instantaneous sound levels were recorded.

The noise level in the Kpansia market was measured in a day. Data were recorded every 20 s for different sections of the market. The sound level meter was placed approximately 1.2 m above ground level (Tubonimi, 2015). Different sections of the market with the likelihood of maximum noise nuisance were chosen for sampling. The Equivalent Noise Level (L_{eq}) was computed using energy summation from the measured data. Equivalent noise levels and statistical methods were used to analyze the field data.

Parameters calculated

Noise Level (L): This is the instantaneous sound pressure level measured at a specific moment. Noise Level (L) was

calculated using equation 2 (Gbimadee and Ugbebor, 2018)

$$L = 10\ Log_{10}\ (10^{LI/10} + 10^{L2/10} + \dots\ 10^{Ln/10}) \quad (1)$$

Equivalent Noise Level (L_{eq}). The equivalent noise level (L_{eq}) is a single constant sound level that contains the same total acoustic energy as the varying noise over a specific period. The Equivalent Noise Level (L_{eq}) was calculated using Equation 2 (Gbimadee and Ugbebor, 2018).

$$L_{eq} = 10log_{10}\left(\frac{1}{T}\sum_{i=1}^{n} 10^{0.1Li} t_i\right) \quad (2)$$

Where; T = the total observed time, Li = Noise level in the ith sample, ti = the duration, n = number of samples

RESULTS AND DISCUSSION

Table 1: Locations and Noise Level Measurement in Kpansia Market

S/N	Location	Noise Level L (dB(A))	S/N	Location	Noise Level L (dB(A))
1	Entrance	78.5	12	Dry Fish	66.4
2	Stockfish	82.1	13	Slippers	69.7
3	Garri	72.4	14	Snail	73.9
4	Groundnut	73.4	15	Tomatoes	73.6
5	Provision	84.4	16	Bedspread	65.2
6	Chicken	74.5	17	Jeans	73.1
7	Inner-road	79.5	18	Provision 2	73.4
8	Potatoes	78.5	19	New Clothes	75.0
9	Yam	76.3	20	Okrika 1	75.3
10	Grinding Machine	94.6	21	Okrika 2	65.4
11	Clothes	77.5			

Table 2: Summary

S/N	Noise Level	Noise Level dB(A)
1	Measured Maximum Noise level (L_{max})	94.6
2	Measuerd Minimum Noise level (L_{min})	65.2
3	Average of study area	75.4
4	NESREA Noise Limit	70
5	WHO Noise Limit	65

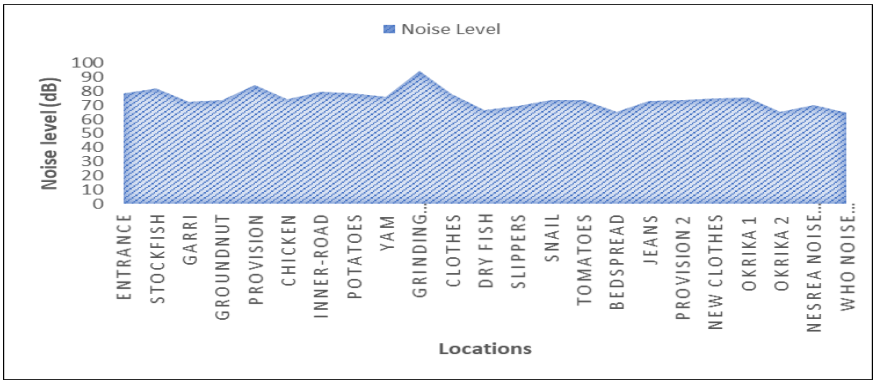


Figure 1: Measured noise level in Kpansia market compared with NESREA and WHO limits

Discussion

Tables 1and 2 records the measured values of noise levels across the Kpansia market and the statistical summary, respectively. Figure 1 displays the measured levels at each location. The measured noise levels in Kpansia Market varied considerably across the different sampling locations, ranging from 65.2 dB(A) in the Bedspread section to 94.6 dB(A) in the Grinding Machine section, as shown in Table 1 and figure 1. The average noise level of the locations in the in the study area was 75.4 dB(A). The high noise level recorded in the Grinding Machine section can be attributed to the operation of mechanical grinding equipment, which is a significant source of environmental noise in markets. The calculated equivalent continuous noise level (Leq) average across the different locations measured in the market was 82.68 dB(A). The average of the study area, 75.4 dB(A), is consistent with reports from other studies. Studies from Oil Mill Market, Port Harcourt

reported substantially higher average levels of 108.2 dB(A), with all sampling points exceeding NESREA's limit for commercial areas (Ugbebor et al.., 2017). Similarly, Delta State markets, including Abraka and Onitsha Park, recorded averages of 86.59–92.15 dB(A) (Ijabor et al..., 2024), with all eight markets exceeding the WHO guidelines. In contrast, Kpansia's average is comparable to Watt Market, Calabar (73.0 dB(A)) and Gwagwalada Market, (70.28 dB(A) on trade days), but remains above the 56.6–70.1 dB(A) range reported across four markets in Akure metropolis (Ekah et al., 2023; Makwe et al., 2024). The relatively lower noise levels in Kpansia's textile sections, such as Bedspread (65.2 dB(A)) and Okrika 2 (65.4 dB(A)), are consistent with those in other markets. Eziukwu Market, Aba recorded 65.0 dB(A) in provision stalls, and Ariaria's Plastic Section was 65.7 dB(A), confirming that mechanical and processing operations, not general trading, drive exceedances (Osisanya et al. 2022). Collectively, these comparisons indicate that the Kpansia Market experiences typical urban market noise exposure for Nigeria, with possible health risks from prolonged exposure in the 75–85 dB(A) zones and isolated to mechanical hotspots requiring targeted intervention.

A comparison of the measured Leq with the permissible daytime noise limit of 70 dB(A) for commercial areas recommended by the National Environmental Standards and Regulations Enforcement Agency (NESREA) indicates that the market environment exceeds the acceptable environmental noise levels.

Conclusion

The noise level in the Kpansia market was measured, and the equivalent noise level (L_{eq}), which is a single constant sound level that contains the same total acoustic energy as the varying noise over a specific period, was calculated to be 82.68 dB(A). This value is higher than both the National Environmental Standards and Regulations Enforcement Agency (NESREA) and World Health Organization (WHO) limits. This result shows that the Kpansia Market exhibits moderate to high environmental noise, with critical exceedance in the mechanical zones. This means that traders and visitors of the market are exposed to high noise levels that are sufficient to cause annoyance and difficulties in communication and concentration, thereby leading to low productivity and other health challenges. These findings suggest the need for effective noise control measures in the market. Such measures may include relocating high-noise activities, such as grinding operations, to designated areas, routine maintenance of mechanical equipment, public awareness campaigns on noise pollution, and enforcement of environmental noise regulations. Continuous monitoring of market noise levels is also recommended to ensure compliance with regulatory standards and to protect public health.

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