Journal for Worldwide Holistic Sustainable Development
ONLINE ISSN: 2409 9384
PRINT ISSN: 2414 3286
2019 VOLUME 5 ISSUE 2 (ONLINE VERSION)
Recommended Citation: Ugonna, U. I., and Okonkwo, F. O. (2020) "Air Quality and Noise Level Assessment of Ode-Aye and Igbotako Towns in Okitipupa LGA of Ondo State" JWHSD, 6, 3-13. Available at: http://www.hsdni.org/jwhsd/articles/

AIR QUALITY AND NOISE LEVEL ASSESSMENT OF ODE-AYE AND IGBOTAKO TOWNS IN OKITIPUPA LGA OF ONDO STATE

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Abstract

This study assessed the air quality and noise level of Ode-Aye and Igbotako towns of Okitipupa Local Government Area of Ondo State. Ode-Aye and Igbotako towns are twin communities of the same environmental, cultural and social characteristics. Handy held monitors were used to measure the air pollutants (NH3, NO2, SO2, CO, H2S) from 12 points chosen across the two towns. The results were compared to the Nigerian Ambient Air Quality Standards and the World Health Organisation guidelines. Results show that NH3, NO2, SO2, CO and H2S were not detected; oxygen remained 20.9 across the 12 sample points; relative humidity was high at 4 points while noise was high at only one point. No VOC was found, particulate matter remained within standards and temperature was also not too high. The study thus concludes that the study area has a relatively good and healthy environment but fears that this may begin to attract industrialists who in no time may destroy the Ode-Aye and Igbotako environment. One of the recommendations is the encouragement of the cultural ways of managing the environment.

Keywords: Pollution, pollutants, health, ecosystem, burning, flaring.

1. Introduction

Air pollution is a recurrent issue in the Niger – Delta region. This is because of the numerous activities especially by the oil companies and transporters ongoing within the region. Air pollution can also come from nature as in the case of pollination. In nature, air pollution is created when volcanoes erupt, forests burn and their smokes are blown by winds and dusts from deserts (Aas et al, 1999). Numerous activities by humans contribute to air pollution as in the study area and release potential lethal substances into the atmosphere (Campbell et al, 1994). Park, 2005 believes that human activities are the primary source of

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PRINT ISSN: 2414 3286
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air pollutants today. This comes from waste products released into the air from the exhaust of internal combustion engines and furnaces of industries, plants and homes.

Clean air sustains man the most and an average person breathes over 3,000 gallons of air each day. It therefore becomes an issue if the air is polluted. Air pollution damages the environment, human health, and quality of life. It makes people sick; causing breathing problems and causing cancer and it harms plants, animals and the ecosystem. Some air pollutants return to Earth in the form of acid rain, which corrode statues and buildings, damage crops and forests, and make lakes and streams unsuitable for fish and other plant and animal life (Hart, 2008).

Clean air is considered to be a rudimentary requirement of human health and well-being. Urban outdoor air pollution is estimated to cause 1.3million deaths worldwide per year. Abattoirs are generally known all over the world to pollute the environment either directly or indirectly from their various procedures (Adelegan 2002; Osibanjo and Adie 2007). In Nigeria, however, meat processing activities are mostly carried out in inappropriate structures and by untrained personnel or butchers who are mostly uninformed of sanitary ethics (Olanike, 2002).

Most air pollution comes from one human activity: burning fossil fuels (natural gas, coal, and oil) to power industrial processes and motor vehicles. Among the harmful chemical compounds that burning puts into the atmosphere are carbon dioxide, carbon monoxide, nitrogen oxides, sulfur dioxide, and tiny solid particles—including lead from gasoline additives—called particulates. Between 1900 and 1970, motor vehicle use rapidly extended, and emissions of nitrogen oxides, some of the most damaging pollutants in vehicle exhaust, increased 690 percent. When fuels are incompletely burned, various chemicals called volatile organic chemicals (VOCs) also enter the air. Pollutants also come from other sources. For instance, decomposing garbage in landfills and solid waste disposal sites emits methane gas, and many household products give off VOCs (Hart, 2008).

In Ode-Aye and Igbotako towns in Okitipupa Local Government Area of Ondo State, serious logging is ongoing and timbre carted by old and worn out trucks which release carbon monoxide from incomplete combustion of their engines. It was reported that in Nigeria, automobile exhaust accounts for about 80%

Journal for Worldwide Holistic Sustainable Development
ONLINE ISSN: 2409 9384
PRINT ISSN: 2414 3286
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of the air pollution problems in the urban areas; the remaining 20% are contributed from industrial sources, the burning of refuse and forest and civil engineering activities (Osibanjo and Ajayi, 1980), also about 15-30% of the emitted lead from automobiles is airborne. It is not uncommon to find people plucking and eating raw fruits, or food hawkers displaying their stuff openly and unwrapped alongside heavy traffic roads which are apparently contaminated with air pollutants. The fire from oil palm mills using fuelwood that grace every inch of the town is also another source. Ideriah et al, 2001 agree that both indoor and outdoor air quality represent a true exposure to humans.

Gas flaring in the Niger-Delta is also significant. Approximately 75 percent of total gas production in Nigeria is flared, and about 95 percent of the associated gas, which is produced as by-product of crude oil extraction, is also flared (The Niger – Delta News, 2004). Gas flaring in Nigeria contributes a measurable percentage of the world's total emissions of greenhouse gases (Gobo, 2002).

No report till date has been given on the air quality of Ode-Aye and Igbotako towns despite all these human activities going on within the town. This research therefore is aimed at assessing the baseline levels of air pollutants and noise in the study area to determine the levels of Sulphur (IV) Oxide (SO2), Nitrogen (IV) Oxide (NO2), Carbon Monoxide (CO), Ammonia (NH3), Volatile Organic Compounds, Hydrogen Sulphide (H2S), Particulate Matter (PM), Oxygen (O2) and noise.

STUDY AREA

The climatic condition of the study area is of the Low Land Tropical Rain Forest type with distinct wet and dry seasons. Temperatures are generally high throughout the year with the maximum and minimum temperatures of 32oC and 31oC respectively. The mean annual rainfall within this area exceeds 2000mm with rains coming scantily in February till October. The heaviest downpour is usually recorded in August and September. The prevailing wind is the South – Westerlies accounting for about 60% of total wind in the area.

The natives are predominantly farmers. The major cash crops being cultivated in the area are oil palm, rubber, cassava and yam. They also farm okro, beans, pepper, vegetables and melon. Their staple foods are but not limited to pupuru (baked cassava), yam, cassava, beans, yam flour and garri.

Journal for Worldwide Holistic Sustainable Development
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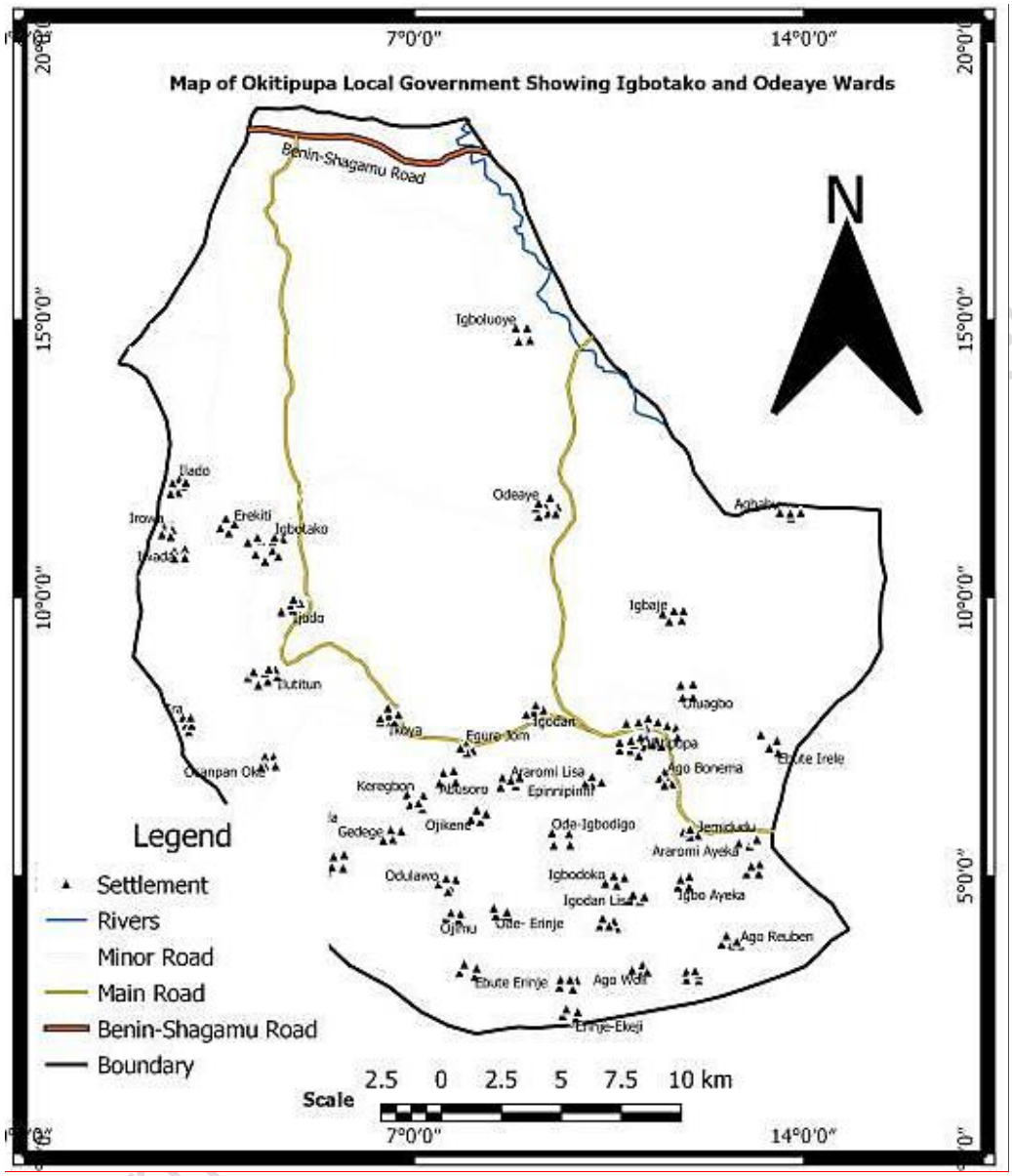

Fig 1, Okitipupa Local Government Area showing Ode-Aye and Igbotako Towns

METHODOLOGY

The sampling equipments employed are handhand held air monitors used to measure the air pollutants. These monitors are as shown in Table 1. Twelve stations including a control station were selected during

Journal for Worldwide Holistic Sustainable Development
ONLINE ISSN: 2409 9384
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reconnaissance between Igbotako and Ode-Aye main towns. The stations and their geographical positions are shown in Table 2. Air quality measurements were made at these stations within the study area using digital handheld air samplers. Ambient air quality measurements in the area were made during the daytime, during the rainy (October 2019) season. Measurements were not made at night due to security reasons. At each station, measurements were repeated several times and the averages taken. These averages were then compared to the Federal Ministry of Environment (FMEnv) and World Health Organisation (WHO) limits for assessment.

Table 1: Air – Quality Parameters and in-situ Measurement Equipment's

Parameter	**Equipment**
Sulphur (IV) Oxide (SO_2)	In-situ single gas SO_2 monitor (ToxiRAE Model PGM-1130)
Nitrogen (IV) Oxide (NO_2)	Single gas NO_2 monitor (ToxiRAE Model PGM – 1150)
Carbon Monoxide (CO)	Gas alert microclip XL (4 – in – one)(Model MXCL XWHM-Y-NA)
Ammonia NH_3	Gas alert estreme NH3 monitor (Model GAXT-A2-DL)
Volatile Organic Compounds	Gas alert microclip XL (4 – in – one)(Model MXCL XWHM-Y-NA)
Hydrogen Sulphide (H_2S)	Gas alert microclip XL (4 – in – one)(Model MXCL XWHM-Y-NA)
Particulate Matter (PM)	Haz-Dust Model HD-1100
Oxygen (O_2)	Gas alert microclip XL (4 – in – one)(Model MXCL XWHM-Y-NA)
Noise Level	Extech integrated sound level meter (Range: up to 130db)

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Table 2: Sampling Points for Air and Noise levels

S/N	Point Code	Description	Coordinates	
			Northings	Eastings
1	ODA 8	Ode-Aye bridge	6º35'03.9''	004º43'19,9''
2	ODA 9	Layelu High School, Ode-Aye	6º34'56.4''	004º43'54.6''
3	ODA 10	St Christopher Ang Church, Ode-Aye	6º35'15.0''	004º44'22.4''
4	ODA 11	Methodist Primary School, Ode-Aye	6º35'24.2''	004º44'52.5''
5	ODA 12	Comprehensive High School, Ode-Aye	6º35'20.5''	004º45'14.1''
6	IGB 1	Igbotako Junction	6º35' 29.4''	004º39'07.4''
7	IGB 2	Debawo Igbotako	6º35'50.2''	004º39'33.5''
8	IGB 3	By Oketiti River Igbotako	6º36'02.5''	004º40'12.8''
9	IGB 4	Within farmland	6º35'53.1''	004º40'47.4''
10	IGB 5	Within farmland	6º35'35.1''	004º41'19.0''
11	IGB 6	Within farmland	6º35'24.4''	004º41'58.7''
12	IGB 7	Within farmland	6º35'16.5''	004º42'35.1''

Table 3: FMEnv and WHO Ambient Air Quality Standards

Parameter	FMEnv		WHO	
	Limit	Time of average	Guideline value	Averaging period/time base
CO	10 ppm 11.4 µg/m^3	1 hour	25 ppm	1 hour
NO_2	0.04 – 0.06 ppm 75.0 - 113 µg/m^3	1 hour	200 µg/m^3	1 hour
SO_2	0.01 ppm 26 µg/m^3	1 hour	0.175 ppm 500 µg/m^3	10 mins
H_2S	0.008 ppm	30 mins	7 µg/m^3	30 mins
PM	250 µg/m^3	1 hour	20 µg/m^3	Annual
			50 µg/m^3	24 hours

Source: Guidelines and Standards for Environmental Pollution Control in Nigeria (FEPA, 1991); Air Quality Guidelines (WHO, 2005)

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ONLINE ISSN: 2409 9384
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The concentration of air quality parameters and noise levels recorded in the study area were compared to the Nigerian Ambient Air Quality Standards (NAAQS) and the World Health Organisation (WHO) Air Quality and Noise Guidelines as shown in Tables 3 and 4.

Table 4: FMEnv and WHO Noise Level Standards and Guidelines

Parameter	FMEnv		WHO	
	Limit	Time of average	Guideline value	Averaging period/time base
Industrial area	90db (A)	8 hours	70 db (A)	24 hours
Residential area	50db	N/A	55 db (A)	16 hours

Source: Guidelines and Standards for Environmental Pollution Control in Nigeria (FEPA, 1991); Air Quality Guidelines (WHO, 2005)

FINDINGS

The results of air pollutants and noise levels measured in the study area are as in Table 5.

Table 5: *In-situ* Air Quality Parameters and Noise Level data

Code	Temp ºC	RH %	Noise db(A)	NH_3 ppm	NO_2 ppm	SO_2 ppm	CO ppm	H_2S mg/m^3	PM µg/m^3	VOC	O_2 %
ODA 8	35.1	55.3	36.8	0.0	0.0	0.0	0.0	0.0	21.1	0.0	20.9
ODA 9	36.4	52.1	59.9	0.0	0.0	0.0	0.0	0.0	22.2	0.0	20.9
ODA 10	35.2	51.0	69.6	0.0	0.0	0.0	0.0	0.0	33.8	0.0	20.9
ODA 11	36.1	55.1	41.8	0.0	0.0	0.0	0.0	0.0	39.1	0.0	20.9
ODA 12	35.8	55.1	51.9	0.0	0.0	0.0	0.0	0.0	20.7	0.0	20.9
IGB 1	32.2	67.1	42.1	0.0	0.0	0.0	0.0	0.0	26.9	0.0	20.9
IGB 2	33.3	72.7	45.2	0.0	0.0	0.0	0.0	0.0	26.8	0.0	20.9
IGB 3	33.2	73.0	37.4	0.0	0.0	0.0	0.0	0.0	21.2	0.0	20.9
IGB 4	33.1	72.0	29.9	0.0	0.0	0.0	0.0	0.0	22.3	0.0	20.9
IGB 5	33.6	59.4	30.1	0.0	0.0	0.0	0.0	0.0	23.0	0.0	20.9
IGB 6	34.1	54.7	34.2	0.0	0.0	0.0	0.0	0.0	20.1	0.0	20.9
IGB 7	35.6	49.2	34.4	0.0	0.0	0.0	0.0	0.0	21.1	0.0	20.9
Range	32.2-36.4	49.2–73.0	29.9-69.6	0.0	0.0	0.0	0.0	0.0	20.1 – 39.1	0.0	20.9

Ambient Air Quality

The air quality results as presented indicate that all parameters measured in the study area were within acceptable FMEnv and WHO limits. Consequently, the ambient air quality in the area can be adjudged to be good.

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Carbon Monoxide (CO)

Carbon monoxide is a colourless, odourless and tasteless gas that is slightly less dense than air. It is produced from the partial oxidation of carbon containing compounds. The CO concentration recorded in the study area is 0.0 ppm. The situation is particularly so because the entire study area is rural with subsistence farming being the major anthropogenic activity. The situation may likely change if the area starts becoming industrialised. It is obvious now that the trucks that transport the harvested timber which release some smoke from their exhaust do create not any significant damage to the environment.

Sulphur Dioxide (SO_2)

Sulphur dioxide or sulphur (IV) oxide (SO_2) is a colourless gas which has been long recognised as a pollutant because of its role along with particulate matter, in forming smog. SO_2 was however not detected within the study area.

Nitrogen Dioxide (NO_2)

Nitrogen dioxide belongs to a family of highly reactive gases called nitrogen oxides. These gases are formed when fuel is burned at high temperatures and come principally from vehicle exhaust and stationary sources such as electric utilities. It also plays a major role in the atmospheric reactions that produce ground-level ozone or smog. This gas was also not detected within the study area.

Hydrogen Sulphide (H_2S)

Hydrogen sulphide is a very corrosive malodourous and toxic gas which is rapidly oxidised to SO_2 in the atmosphere. It causes eye irritation and odour annoyance. Exposure to concentration in excess of 500 ppm can be fatal. Its non-detection in the ambient air in the study area suggests that no activity leading to the significant emission of the gas was going on at the time of this study.

Particulate Matter

Particulate matters are finely divided air borne particles which can be of atmospheric and or natural origin. They are present in ambient air in the form of dust, fumes, smoke and other aerosols. Although air borne

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particles are of varying sizes, those that are less than 10 μm in aerodynamic diameter are of most concern because of their ability to get inhaled into the lungs and cause respiratory problems.

From the result, the particulate matter in the study area ranged from 20.1 – 39.1 $\mu g/m^3$. The range has been found to be within the FMEnv permissible limit of 250 $\mu g/m^3$ and WHO limit of 50 $\mu g/m^3$ for a 24-hour averaging period.

Volatile Organic Compounds

Volatile organic compounds (VOCs) are chemical compounds that have enough high vapour pressure under normal conditions to significantly vaporize and enter the air. A wide range of carbon – based molecules are considered VOCs such as aldehydes, ketones and hydrocarbons. Exposure to high concentration of VOCs in the atmosphere (about 1000 ppm or more) could result to interference in oxygen intake, thus fatal to humans. VOCs were however not detected within the study area.

Ambient Noise Level

The ambient noise level recorded within the study area ranged from 29.9 – 69.6 db (A) and falls within the FMEnv permissible noise exposure limits of 90 db (A). Noise level as recorded is higher at the marketplaces than elsewhere. However, the points that measured 59.9 and 69.6db have crossed the WHO limit of 55db for a 16- hour averaging period.

CONCLUSION

Clean air sustains man the most and an average person breathes over 3,000 gallons of air each day. It therefore becomes an issue if the air is polluted. Air pollution damages the environment, human health, and quality of life. It makes people sick; causing breathing problems and causing cancer and it harms plants, animals and the ecosystem. Some air pollutants return to Earth in the form of acid rain, which corrode statues and buildings, damage crops and forests, and make lakes and streams unsuitable for fish and other plant and animal life (Hart, 2008). Clean air is considered to be a rudimentary requirement of human health and well-being. Urban outdoor air pollution is estimated to cause 1.3million deaths worldwide per year.

Ode-Aye and Igbotako towns based on the data collected from the field and analysed could be seen to be free from air pollutants with relative humidity that is fair for human survival. All the indices measured were

found to be within the limits of the FMEnv and WHO guidelines. This air quality rating in the communities could be as a result of the villagers preferring to trek even long distances than biking; open defecation though practiced here is not carried out around the residences but within the forests; the heavy trucks that come to carry timber do so at particular times and slash and burn of farm lands are highly discouraged. However, with the government presence blossoming in the area, the fear of population increases leading to human activities that may harm the environment is imminent. These results thus form a baseline for future references.

This study thus recommends that;

1. Authorities responsible for managing the environment have to sit up in their duties and
2. Cultural methods for managing the environment should continue to be encouraged.

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