Global Scientific JOURNALS

GSJ: Volume 11, Issue 12, December 2023, Online: ISSN 2320-9186
www.globalscientificjournal.com

AIR QUALITY ASSESSMENT OF SOME SELECTED AREAS IN ELEME, PORT HARCOURT. RIVERS STATE, NIGERIA.

Erhuen Ejomafuvwe[1], Aziza A.E[1], Gabriel T. Buluku[2], Oriomah C[3], Akusu, P. Oghenegare[4].

1. Department of Science Laboratory Technology, Petroleum Training Institute, Effurun, Delta State, Nigeria.
2. Department of Chemistry, Benue State University, Makurdi, Benue State, Nigeria.
3. Department of Environmental Management and Toxicology, Delta State University of Science and Technology, Ozoro, Nigeria.
4. Department of Chemical Sciences, College of Science, Afe Babalola University, Ado-Ekiti, Ekiti State, Nigeria.

Keywords: Air quality, Ambient standard, Atmospheric pollutants, Health effect, Human activities, Industrial Area, Residential area.

Abstract

This study focuses on air quality monitoring at Eleme Area of Portharcourt in order to determine the concentration level of air pollutants present in the atmosphere and the level of exposure to plants, animals, and humans. Air pollutants from Onne, Alesa and Akpajo was analyzed and monitored for a period of three (3) weeks. The result showed high concentration of CO at ONNE (51.4ppm), ALESA (44.09ppm) and AKPAJO (31.11ppm) while the control point GRA showed a low concentration of 14.08ppm. VOCs showed high concentration at ONNE (10.36ppm) while lower concentrations were observed at ALESA (0.66ppm), AKPAJO (0.31ppm) with GRA (0.093ppm). High concentration of NO_2 was observed at AKPAJO (0.23ppm) with lower concentrations at ALESA (0.047ppm), ONNE (0.048ppm) and GRA (0.087ppm). $PM_{2.5}$ was discovered to be high at ONNE (5.57ppm) and GRA (4.11ppm) while lower concentration was observed at ALESA (0.028ppm) and AKPAJO (2.23ppm). PM_{10} was more concentrated at GRA

*Corresponding author. Tel.: +234-806-347-2797.
E-mail address: gbuluku@bsum.edu.ng

(5.67ppm) with low concentration at ALESA (2.605ppm), ONNE (2.28ppm) and AKPAJO (0.034ppm). Results indicated that host communities were exposed to moderate to high concentrations of volatile organic compounds, and carbon monoxide which may adversely aggravate health conditions under prolonged exposure in these communities.

1.0 INTRODUCTION

Air quality is an important issue worldwide due to the health implications on man and livestock (Francis *et. al* 2023). This is as a result of rapid industrialization, fast urbanization, rapid growth in population, drastic increase in vehicles on the road and other activities of human beings.

As a result of the foregoing, there is now a growing concern about the pollution of the atmospheric air by man-made activities. Though many of the gaseous pollutants are also emitted by nature (such as volcanic eruptions), anthropogenic activities adversely affect the quality of air, particularly near dense urban areas and near large emission sources. Major primary pollutants by human activities include sulphur oxides, nitrogen oxides, carbon oxides, volatile organic compounds (VOCs), Chlorofluorocarbon (CFCs), particulate matter, toxic metals and radioactive pollutants (Okuo *et. al* 2010).

Major activities during production process involve the use of chemical whose bye products constitute industrial waste that are sometimes discharged carelessly into the environment through pipes, drains, air and land and find their way into water used for drinking, fishing and other purposes (WHO, 2017; Oderinde, *et.al.,* 2016).

However, exposure to air pollutants has been reported to cause health effects, genetic structure alterations, weaken immune system, asthma, headache, dry eyes, nasal congestion, nausea, and fatigue depending on the type of pollutants, amount of pollutants, frequency of exposure and associated toxicity of specific pollutants (Azeez *et. al* 2012).

Air quality assessment and monitoring is therefore very important in determining the nature of population exposure to atmospheric pollutants which may result in a variety of health effects. Air quality (AQI) rating therefore, may be useful in understanding the atmospheric concentration levels of a locality since it helps in the classification of the health conditions inherent in human exposure to air pollution. Thus, the need of assessing the air quality condition within Eleme metropolis owing to increase in population, industrialization and urbanization levels of the area.

Study Area

The area under study includes towns and communities that make up the Eleme Local Government Area such as Onne, Akpajo, and Alesa. These locations have some companies and industries that carry out various industrial activities including exploration, automobile activities, etc., some of which contribute majorly to the atmospheric gases in the vicinity.

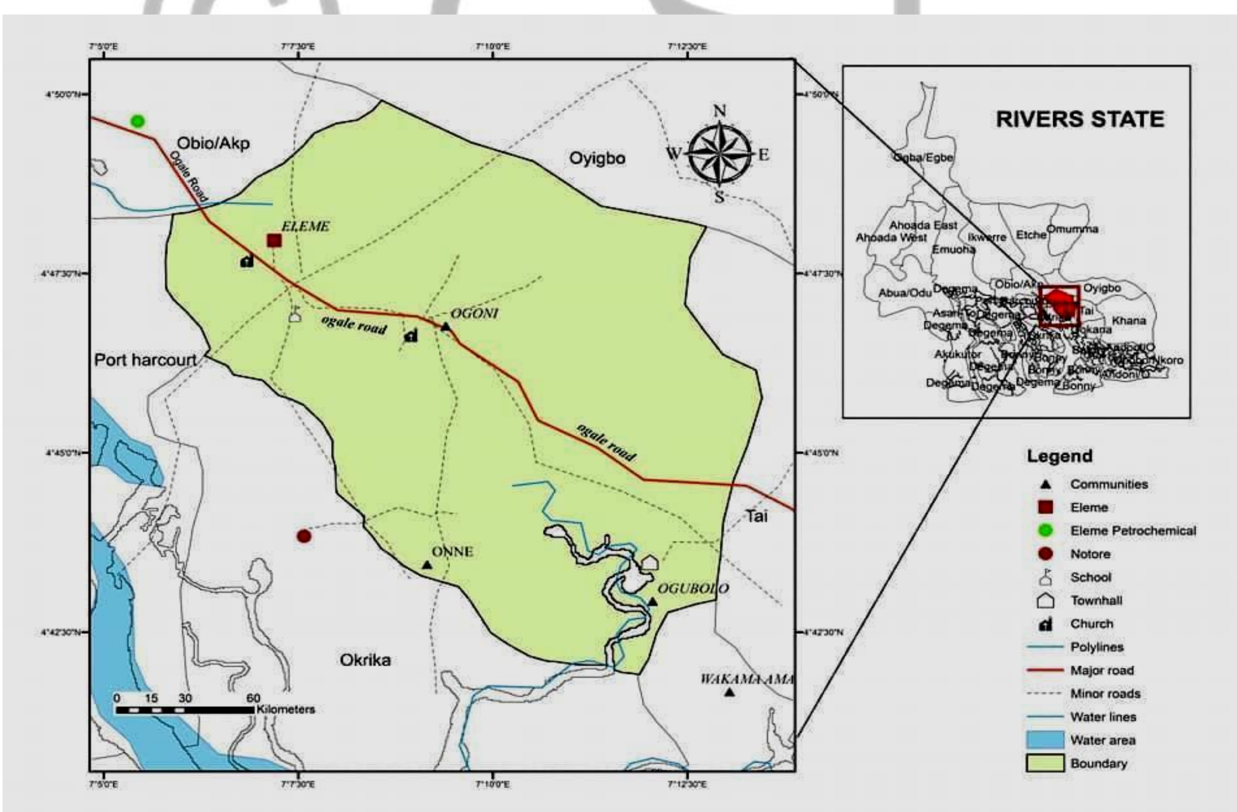

Figure 1.0: Map showing Eleme towns and communities.

2.0 MATERIALS AND METHODS

This study was carried out using the systematic sampling method by monitoring the concentration level of air pollutant such as; Carbon Monoxide (CO), Volatile Organic Compounds (VOCs) Sulphur (IV) Oxide (SO_2), Nitrogen (IV) Oxide (NO_2), Particulate Matter 2.5 ($PM_{2.5}$) and Particulate Matter 10 (PM_{10}).

Instruments such as the Aeroqual series 500 with swappable sensor heads and GPS Map 78s were used in data collection.

Data from each location was obtained by running the process for at least three times to get an average value for the total number of pollutant under consideration which was analyzed at the end of each section of the day. The data obtained from the sampling locations after a period of three (3) weeks was compared using the control point (GRA) and National Air Ambient Quality Standard (NAAQS).

3.0 RESULTS AND DISCUSSION

The result of the concentration of air pollutants after the sampling and analysis are table-mate below

Table 1.0: Weekly Concentrations of Air Pollutants in the Study Area

Parameters	Onne			Alesa			Akpajo			GRA
	Week 1	Week 2	Week 3	Week 1	Week 2	Week 3	Week 1	Week 2	Week 3	Control
CO(ppm)	45.43	61.67	47.10	34.17	53.43	44.67	32.43	36.0	24.9	4.6
VOCs	2.61	24.7	3.77	0.15	0.33	1.50	0.14	0.2	0.6	0.04
SO_2(ppm)	0.02	1.33	1.33	0.001	0.001	0.01	0.05	1.33	1.33	0.073
NO_2(ppm)	0.06	0.01	0.073	0.12	0.01	0.013	0.05	0.01	0.01	0.06
$PM_{2.5}$	3.33	6.67	6.67	0.07	0.007	0.07	0.02	0.02	6.67	0.005
PM_{10}	6.67	0.08	0.08	7.67	0.075	0.07	0.010	0.021	0.07	0.006

Table 2.0: Mean Concentrations of Air Pollutants in the Study Area

Parameters	Onne	Alesa	Akpajo	Control
CO(ppm)	51.4±0.02	44.09±0.12	31.11±0.04	14.08±0.07
VOCs	10.36±0.55	0.66±0.14	0.31±0.11	0.093±0.55
SO_2(ppm)	0.88±0.11	0.004±0.71	0.90±0.08	0.048±0.23
NO_2(ppm)	0.048±0.09	0.047±0.23	0.23±0.45	0.087±0.61
$PM_{2.5}$	5.57±0.01	0.028±0.22	2.23±1.33	4.11±0.44
PM_{10}	2.28±0.33	2.605±0.32	0.034±0.07	5.67±0.03

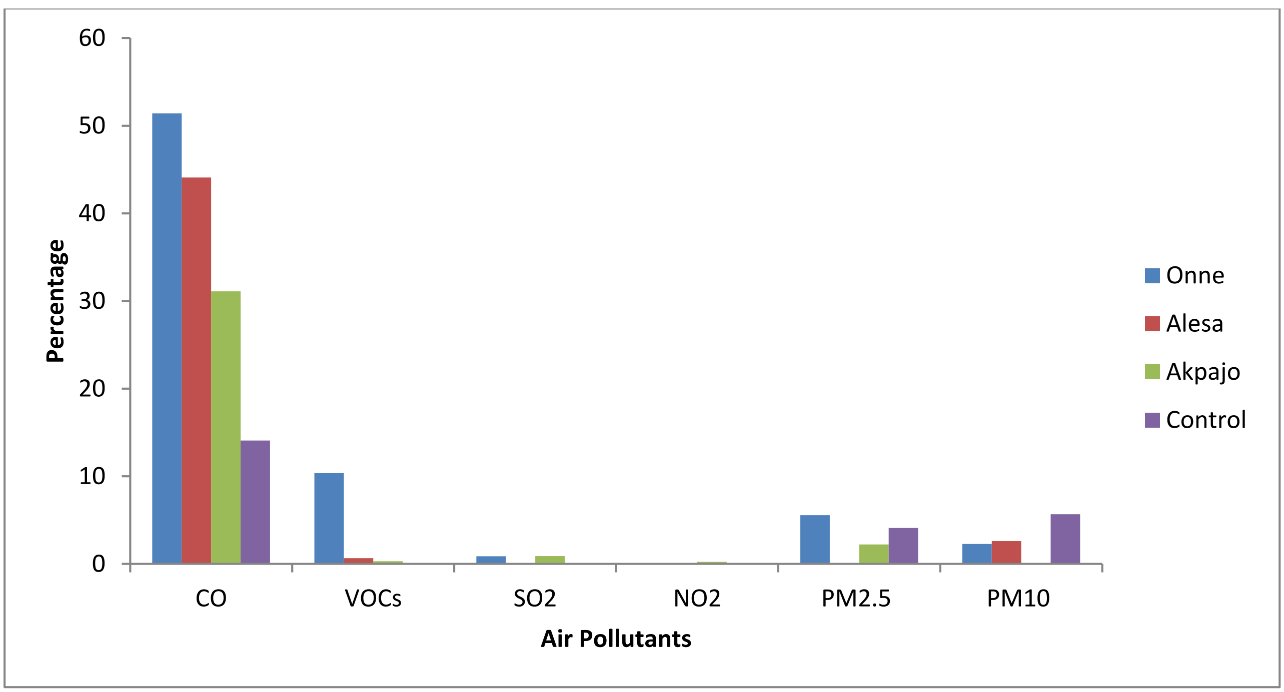

Figure 2.0: Graph of Mean Concentration Levels of CO_2, VOCs, SO_2, NO_2, $PM_{2.5}$ & PM_{10} from Week 1 - Week 3

Table 3.0: National Ambient Standard in 40 C.R.F. 50 (40 of the code of Federal Regulation

Pollutant	Type	Standard Maximum (Ambient Concentration)	Averaging Time
SO_2	Primary	75ppb	1-hour 40, 50
SO_2	Secondary	0.5 ppm (1,300 µg/m^3)	3- hour40, 50
PM_{10}	Primary and Secondary	150 µg/m^3	24-hour 40, 50
$PM_{2.5}$	Primary	12 µg/m^3	Annual40, 50
$PM_{2.5}$	Secondary	15 µg/m^3	Annual40, 50
$PM_{2.5}$	Primary and Secondary	35 µg/m^3	24-hour 40, 50
CO	Primary	35ppm (40 µg/m^3)	1-hour 40, 50
CO	Secondary	9ppm (10 µg/m^3)	8-Hour40, 50
CO	Primary and Secondary	0.12ppm (235 µg/m^3)	1-hour40, 50
O_3	Primary and Secondary	0.070 ppm (140 µg/m^3)	8-hour 40, 50
NO_x	Primary and Secondary	0.053 ppm (100 µg/m^3)	Annual40, 50
NO_x	Primary and Secondary	0.053 ppm (100 µg/m^3)	Annual40, 50
NO_2	Primary and Secondary	0.12 ppm 0.03ppm	1-hour 40, 50 1 Year
CO_2	Primary	9ppm	1-hour 40,
CO_2	Secondary	35 ppm	8–hours 50,

Discussion of Result

From the result in Table 1, Carbon monoxide was observed to exceed the limits of 0.12ppm with the concentration majority observed in industrial and residential areas which could be attributed to combustion from motor vehicles heaters, industrial waste products, fossil fuels etc. Comparison with control sites showed a lower value of carbon monoxide which could be attributed to low concentration of fossil fuels.

Volatile organic compounds are released from sources including paints, building materials amongst others. The concentration observed was significantly above the control limits of 0.093ppm which can be attributed to the absence of generating source. The concentrations of sulphur oxide and Nitrogen oxide were observed within allowable limits. Observed concentration levels could be due to the presence of power generating engine. The presence of particulate matter was observed at concentration lower than recommended limit which can be attributed to reduction of vehicular movement especially at the control area. However, it was considerably higher than that of control area.

The analysis of Carbon monoxide and volatile organic compound as tabulated in Table 1 was relatively high at industrial area (61.67ppm and 24.7ppm) showing high combustion activity as compared to control area of 4.60 to 0.04ppm. The high value observed from the control may be due to running of power engineering resulting to combustion as well as other domestic activities. Sulphur oxide and nitrogen oxide assessed were also observed to be high at industrial areas showing possible environmental pollution around Port Harcourt area. Nkwocha and Mbonu, (2010) showed a similar result at Effect of Gas flaring on building in the oil producing rural communities of Rivers State, Nigeria. Also, the observed value of particulate matter can be attributed to background level as concentrations were observed to be minimal. This may be because of reduced activities such as vehicle movement could have given rise to particle movement as well as seasonal variation. Zagha and Nwaogazie (2015) reported that all study areas in Port Harcourt, in exception of Bodo street or new GRA (control), posed serious health risks to individuals who spent long hours within these areas. Assessment of other pollutants showed low pollution levels. The concentration of carbon monoxide as indicated in Table 2 varied between 31.11 to 51.4ppm for industrial, commercial and residential area with a lower value of 14.08ppm for control area. Volatile organic compounds were also observed due to generating source. The concentrations of pollutants regarding nitrogen dioxide and sulphur dioxide were relatively low and within allowable standard limit of 0.12ppm and 0.5ppm respectively. These may be due to the absence of major industrial activities such as burning of coal which could result in the dispersion of this pollutant into air. This obtained pollution value increased significantly compared to control location which may be attributed to combustion.

4.0 CONCLUSION

The air quality assessment of Eleme Area around Port Harcourt metropolis showed high concentrations of Carbon monoxide, Volatile Organic Compound and Particulate Matter which, as a result of the activities of oil companies, have negative impacts on the natural air quality of the environment within these host communities. Results indicated that host communities were exposed to moderate to high concentrations of volatile organic compounds, and carbon monoxide which may adversely aggravate health conditions under prolonged exposure in these communities (Onne, Alesa and Akpajo). It is important to maintain reduced environmental pollution to minimise the level of carbon monoxide, volatile Organic Compound, sulphur dioxide, nitrogen dioxide and particulate matter overtime.

References

1. L.A. Azeez, M.D. Adeoye, A. Lawal, B. Agbaogun, "Levels of Hazardous Air Pollutants and Volatile Organic Compounds in low-income houses in Lagos". *Advances in Environmental Research*, Vol. 1, No. 4 277-288. 2012.
2. F.O. Abulude, S.A. Ademola, S. Adamu, K. M. Araifalo, A.M. Kenni, L.J. Bello, A.O. Gbotoso. "Assessment of Air Quality Using the Plume Air Quality Index Indicator (PAQI): Reference to Five Towns in Nigeria". *ASEAN Journal of Science and Engineering* 3(3). 251-258. 2023.
3. E.E. Nkwocha, and E.C Pat-Mbano. "Effect of Gas Flaring on Building in the Oil Producing Rural Communities of River State Nigeria". *African Research Review*, 2(2) April, 2010.
4. O.K. Oderinde, S.O. Babajide, C.O. Adeofun, S. Liu and O. Akinyemi. "Investigating the Vehicular Carbon Monoxide Concentration in the Central Region of Ogun State, Nigeria". *Journal of Environmental Science, Toxicology and Food Technology*, 10(5 Ver 1): 90-98.
5. J. M. Okuo, D. E. Ogbeifun, A.P. Oviawe, and E.C. Nwosu. "Air Quality Status Of Volatile Organic Compounds in Health and Financial Institution Microenvironments In Benin City, Nigeria" *Global Journal of Pure and Applied Sciences* Vol. 17, No.3,: 299-306. 2011.
6. W.H.O, World Health Organization, 2017. "Country Estimates on Air Pollution Exposure and Health Impact" http://www.who.int/mediacenter/news/releasese/2016/air pollutionestimates/en/(accessed on 23 July 2021).
7. O. Zagha, and I.L. Nwaogazie (2015). Roadside Air Pollution Assessment in Port-Harcourt, Nigeria. *Standard Research Journals*, 3, 23-34.