

Assessment of Air Quality Levels in the Major Towns Across Benue Zone C, Nigeria

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ABSTRACT Air pollution is as old as civilization itself. nature produces air pollution, and so do human activities that pollute the environment on a daily basis. this has become a thing of concern and hence, need serious attention. this study assessed air quality levels in five (5) local government areas (lgas) of benue zone c, covering busy roads, garages, schools, residential areas, hospitals, hotels, and markets. the results obtained depicted that the concentration of the air pollutants is at the permissible limit set by who and fmenv except hcho with concentration of 0.0010 mg/m³ to 0.7102 mg/m³ and tvoc with a concentration of 0.0160 mg/m³ to 0.5686 mg/m³ against 0.10 mg/m³ and 0.30 mg/m³ respectively, which is higher in some locations in okpoga, otukpo, oju and ugbokpo. since hcho and tvoc exceeded the permissible limit set by regulatory bodies in some local government areas (otukpo, oju, apa and okpokwu) which can pose serious environmental and health complications in the area. hence, there is need for strict environmental rules to restrict the emission of hcho and tvoc in the areas affected, implementation of strict emission controls, improvement of ventilation, use low voc materials, enhancement of green infrastructure and also enforcement of air quality regulations.

KEYWORDS: Air pollutant, Concentration, FMEnv, Monitor, Regulatory body, WHO

I. INTRODUCTION

Air pollution is as old as civilization itself. Nature produces air pollution, but so do human activities that pollute the environment on a daily basis. When volcanoes erupt (or when they spew significant quantities of ash and sulphur dioxide into the sky), when forest fires burn and the smoke is carried away by the wind, and when the wind carries plant pollen and dust in deserts, air pollution occurs. Numerous human activities lead to the emission of potentially harmful compounds into the atmosphere [1]. The wastes released into the air by internal combustion engines, boilers, and furnaces in industries, factories, and homes are today's primary sources of air pollutants due to human activity [2]. The first observable and oldest environmental effect of cities on climate [3] is air pollution, which is one of the major environmental challenges linked to urbanization and expansion [4]. Air pollution is a major challenge of the Anthropocene, endangering the stability of Earth systems, causing global climate change, harming ecosystems, and endangering human health [5]. If there are a lot of foreign gases or solids in the atmosphere, it is said to be contaminated [6]. According to [7], air pollutants are compounds that, under certain circumstances, are present in the atmosphere and have the potential to impair human, animal, plant, or microbiological life or property or to obstruct the use and enjoyment of life. Urban regions' quality of life is significantly impacted by noise, a by-product of urbanization and industrialization that is now acknowledged on a global scale [8]. A sense of annoyance, disruption, or irritation caused by noise is very common in urban centres. People can be adversely affected by noise in a variety of ways, and road noise has a significant detrimental impact on people's physical and mental

health [9]. Children's bodies which are still developing, according to studies, need no noise because it's detrimental to them [10]. Though it has gradually grown to be a very significant pollutant and a threat to the quality of man's atmosphere, it is still persistently upsetting human serenity and tranquillity [11].

II. RELATED WORKS

In research conducted by [3], where they evaluated the spatio-temporal and seasonal discrepancy in the concentration of CO, NO₂, SO₂ and PM₁₀ in Gboko, Benue State, Nigeria. Data on the air pollutants were collected at four points between 8:00am-10:00am and 3:00pm-5:00pm daily, from 16th January to 24th February (dry season) and 5th June to 14th July (rainy season) in 2017 using Gasman hand-held gas monitors. Data were analysed using mean, coefficient of variation (CV) and Analysis of Variance (ANOVA). The result showed highest and lowest mean concentrations of CO of 21.86ppm (rainy season) and 17.00ppm (dry season) in the town centre (Point 2, GBKC) and 2.46ppm (rainy season) and 2.45ppm (dry season) in the suburb (Point 1, YRA). The mean concentrations of CO, NO₂ and SO₂ were higher in rainy season, and the mean concentration of PM₁₀ was higher in dry season, with the mean concentrations of NO₂, SO₂ and PM₁₀ higher than the national acceptable levels in both seasons. The spatial variation in concentration of the air pollutants was significant with respect to land use/land cover types than seasons. Whereas the research was limited to only four (4) air pollutants. In the same vein, [1] carried out a related study where the quality of air levels around Okirika communities in River State were determined using portable handheld air monitors for air pollutants and anemometer for meteorological parameters. The parameters measured were suspended particulate matter, nitrogen dioxide, sulphur dioxide, hydrogen sulphide, ammonia, carbon monoxide, methane and volatile organic carbon, temperature, wind speed, wind direction and relative humidity. The results showed the highest concentrations of 0.007mg/m³ (PM₁, dry), 0.036mg/m³ (PM_{2.5}, dry), 0.286mg/m³ (PM₇, dry), 0.378mg/m³ (PM₁₀, dry), 0.503mg/m³ (TSP, dry), 1.7ppm (NO₂, dry), 3.0ppm (CH₄, dry), 0.2ppm (H₂S, dry), 12.7ppm (CO, dry), 2.7ppm (NH₃, dry), and 7.0ppm (VOC, rainy). The dry season concentrations of air pollutants were higher than the rainy season concentrations. The observed differences in mean concentrations of the air pollutants between the two seasons were not significant in case of TSP ($P < 0.05$) but were significant ($P < 0.05$) in other pollutants. The highest mean concentrations of the gaseous pollutants exceeded permissible limits and therefore pose environmental and health concern for the inhabitants of the area. However, study on adequate monitoring of air quality, pollution index and weak enforcement of standard has not or seldom been reported in Benue Zone C. With regard to the aforementioned, this work Centered around assessing the air quality levels in a selected areas of Benue Zone C which will help in formulating essential air and noise pollution data to guide informed decision-making on urbanization, industrialization, and contribute to sustainable development efforts. The selected areas were chosen based on the level of activities and the population of the inhabitants.

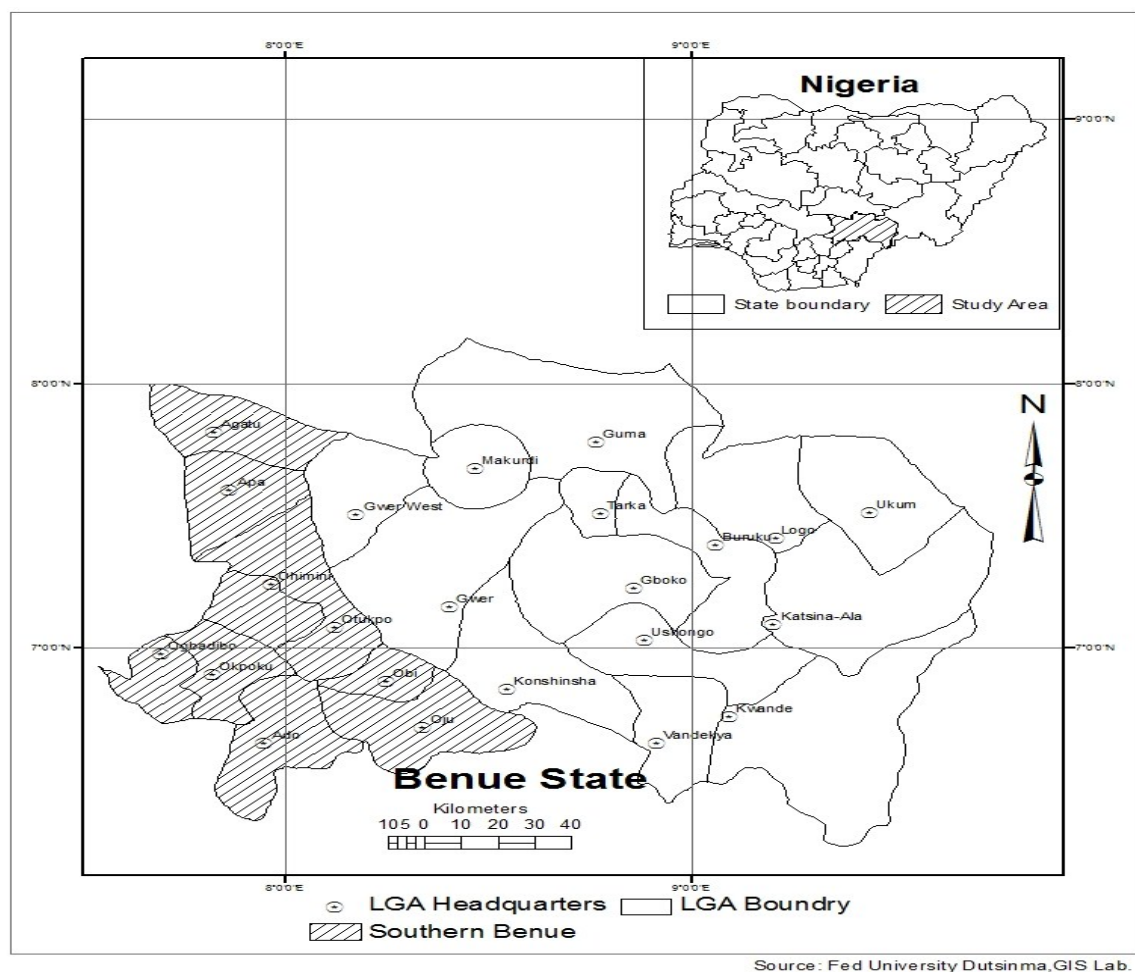
III. MATERIALS AND METHODS

A. STUDY AREA

This research was carried out in the major towns in Benue Zone C (Benue South) putting into consideration the various federal constituencies located in the area. Hence, the study was carried out in Otukpo, Oju, Otukpa, Okpoga and Ugbokpo. The research was concentrated in the densely populated areas and highly busy areas (i.e Busy Road, Market, residential zone, Hotels, School, Hospital and Garage). Benue zone C is characterized by a tropical sub-humid climate with a wet and dry season. The seven-month wet season begins in April and finishes in October. The total yearly rainfall varies between 1,200 mm and 1,500 mm, especially in the months of March and April, daily high temperatures are the norm. These high temperatures, combined with the high relative humidity, provide unfavourable or disabling weather conditions along the river valleys. The zone is primarily populated by Idoma and Iggede-speaking people and has an estimated area of 7,500 sq. km. and 1,307,647 inhabitants [12]. The areas were chosen based on their industrial activities, fast growth in urbanization, population growth and Federal constituencies.

Table 1: Identification of Sampling Stations with Geographical Locations of the Study Areas

	OTUKPA		OKPOGA		OJU		UGBOKPO		OTUKPO	
LOCATION	LONG.	LAT.	LONG.	LAT.	LONG.	LAT.	LONG.	LAT.	LONG.	LAT.
BUSY ROAD	7.6691	7.1396	7.7561	7.1559	8.3476	7.15587	8.5676	8.5555	8.5565	8.1506
GARAGE	7.5832	6.9957	7.7573	7.1958	7.7573	7.1958	8.0853	7.8596	7.8254	6.5743
SCHOOL	7.5860	7.0010	7.7597	7.1010	7.7597	7.1010	7.0065	7.7810	7.1055	7.8010
RESIDENTIAL ZONE	7.5832	6.9957	7.7832	7.9957	7.7832	6.9957	7.6548	6.7557	8.6541	7.8571
HOSPITAL	7.5832	6.9973	7.7832	7.9973	7.7832	7.9973	7.6783	6.6983	8.7853	7.6543
HOTEL	7.5828	6.9966	7.7828	6.8967	7.7828	6.8966	7.6768	6.6799	8.8768	7.8800
MARKET	7.5828	7.0010	7.7879	7.8610	7.7880	7.8610	7.6788	7.7709	7.8768	7.8767

**Figure 1:** Benue South Location Map

B. DATA COLLECTION OF AIR POLLUTANTS

Data on the concentration of air pollutants [carbon monoxide (CO), Nitrogen dioxide (NO₂), Sulphur dioxide (SO₂), Particulate Matters (PMs: PM_{2.5}, PM₁₀), Formaldehyde (HCHO), Carbon (iv) Oxide (C O₂), Ozone (O₃) and Total Volatile Organic Compounds (TVOC)] was measured three (3) times each day between 8 a.m. - 10 a.m. (Morning), 12 noon – 2 p.m.(Afternoon) and 5 p.m. - 7 p.m. (Evening)

for 5 days in each location, using Gasman Hand-held Gas Monitors and JLDG Air Quality Tester (Produced by Dongguan Jinlide Electronic Technology Co., Ltd, China). Readings were taken in each location, morning, afternoon and evening (i.e., 21 readings per day and 105 in 5 days), and thereafter the mean value was evaluated. The Gasman Hand-held Gas Monitors was used to measure CO, NO₂, SO₂, PM_{2.5}, PM₁₀, and O₃, whereas JLDG Air Quality Tester was used to measure HCHO, TVOC and CO₂.



Figure 2: (a) Hand-Held Gasman Pollutant Monitors

(b) JLDG Air Quality Tester

The Air Quality Tester has the following specification:

- (a). CO₂ measuring range: 350ppm~2000ppm
- (b). TVOC measuring range: 0.000mg/m³~2.000mg/m³
- (c). HCHO measuring range: 0.000mg/m³~1.000mg/m³
- (d). Temperature measuring range: 0°C~90°C (Precision, 0.1°C), 32°F~194°F (Precision, 0.1°F, above 100°F display integers).
- (e). Humidity Measuring range: (0~99.0) %RH (Precision 0.1).

Hand-Held Gasman Pollutant Monitors and JLDG Air Quality Tester that was used for the Study were chosen because of their precision, durability and can function even in an area where there's no internet services because it doesn't need internet service to function properly. Meanwhile, both air pollutant monitors were re-calibrated before usage to avoid zero error during result reading. These instruments were used successfully by [1], [3], [5] and [13] in their various researches to ascertain air quality of air.

IV. RESULTS AND DISCUSSION

Table 2: Mean Concentrations of Air Pollutants Measured in Ugbokpo (APA Local Government Area)

LOCATION	Mean Concentrations of air pollutants measured								
	PM _{2.5} (µg/m ³)	PM ₁₀ (µg/m ³)	SO ₂ (µg/m ³)	HCHO (mg/m ³)	NO ₂ (µg/m ³)	CO (µg/m ³)	CO ₂ (ppm)	O ₃ (µg/m ³)	TVOC (mg/m ³)
BUSY ROAD	2.85	5.50	0.76000	0.0635	0.80	380.00	431.10	33.50	0.3532
GARAGE	5.30	8.50	0.6090	0.0636	1.55	424.30	438.50	30.10	0.0465
SCHOOL	4.75	6.35	0.5250	0.0503	1.35	380.30	472.75	38.35	0.08375
RESIDENTIAL ZONE	4.325	5.15	0.0465	0.0657	1.38	530.30	470.00	37.00	0.07783
HOSPITAL	4.90	6.10	0.0586	0.0618	1.33	550.60	414.00	41.10	0.0756
HOTEL	5.70	7.80	0.4543	0.0653	1.50	409.60	477.00	39.80	0.0780
MARKET	8.20	8.70	0.5532	0.0242	1.00	454.00	544.00	33.50	0.0653

Table 3: Mean Concentrations of Air Pollutants Measured in Oju (OJU Local Government Area)

LOCATION	Mean Concentrations of air pollutants measured								
	PM _{2.5} (µg/m ³)	PM ₁₀ (µg/m ³)	SO ₂ (µg/m ³)	HCHO (mg/m ³)	NO ₂ (µg/m ³)	CO (µg/m ³)	CO ₂ (ppm)	O ₃ (µg/m ³)	TVOC (mg/m ³)
BUSY ROAD	4.85	4.50	0.5600	0.4735	2.70	567.00	345.12	25.50	0.3658
GARAGE	8.70	9.00	0.6000	0.6160	3.55	587.30	428.50	28.10	0.0685
SCHOOL	5.75	9.35	0.6250	0.7102	1.35	488.30	356.75	28.35	0.0737
RESIDENTIAL ZONE	6.32	8.15	0.4065	0.0757	2.35	455.30	423.50	29.85	0.0678
HOSPITAL	6.90	6.10	0.1743	0.6010	1.20	447.60	432.00	28.10	0.0710
HOTEL	5.90	5.80	0.3984	0.4057	2.30	479.60	345.00	26.80	0.0860
MARKET	8.2	6.7	0.4782	0.1010	3.00	674.00	434.00	30.50	0.0980

Table 4: Mean Concentrations of Air Pollutants Measured in Okpoga (OKPOKWU Local Government Area)

LOCATION	Mean Concentrations of air pollutants measured								
	PM _{2.5} (µg/m ³)	PM ₁₀ (µg/m ³)	SO ₂ (µg/m ³)	HCHO (mg/m ³)	NO ₂ (µg/m ³)	CO (µg/m ³)	CO ₂ (ppm)	O ₃ (µg/m ³)	TVOC (mg/m ³)
BUSY ROAD	3.850	7.50	0.5000	0.0535	0.90	580.00	531.125	36.50	0.4532
GARAGE	6.700	9.00	0.7090	0.0546	2.55	574.30	478.500	31.10	0.0885
SCHOOL	5.750	7.35	0.6250	0.0603	1.35	480.30	482.750	36.35	0.07375
RESIDENTIAL ZONE	5.325	7.15	0.0565	0.0757	0.38	501.30	490.000	36.00	0.08783
HOSPITAL	3.90	8.10	0.1986	0.0718	1.20	555.60	452.000	42.10	0.0676
HOTEL	5.90	8.80	0.3543	0.0253	1.30	489.60	467.000	38.80	0.0560
MARKET	9.20	7.70	0.5432	0.0342	2.00	774.00	534.000	31.50	0.1053

Table 5: Mean Concentrations of Air Pollutants Measured in Otukpa (OGBADIBO Local Government Area)

LOCATION	Mean Concentrations of air pollutants measured								
	PM _{2.5} (µg/m ³)	PM ₁₀ (µg/m ³)	SO ₂ (µg/m ³)	HCHO (mg/m ³)	NO ₂ (µg/m ³)	CO (µg/m ³)	CO ₂ (ppm)	O ₃ (µg/m ³)	TVOC (mg/m ³)
BUSY ROAD	2.85	5.50	0.2000	0.0735	0.70	480.00	462.13	31.50	0.1658
GARAGE	4.70	7.05	0.2000	0.0160	1.55	507.30	428.50	26.10	0.0485
SCHOOL	2.75	5.35	0.2250	0.0103	0.35	457.30	442.75	36.35	0.0537
RESIDENTIAL ZONE	3.325	6.15	0.0065	0.0058	0.35	452.30	442.00	36.85	0.0378
HOSPITAL	1.90	3.18	0.1000	0.0010	0.20	440.60	402.00	40.10	0.0210
HOTEL	2.93	5.82	0.3000	0.0050	0.30	460.60	432.00	36.80	0.0160
MARKET	5.25	6.77	0.0542	0.0010	0.50	454.00	422.00	29.50	0.0654

Table 6: Mean Concentrations of Air Pollutants Measured in Otukpo (OTUKPO Local Government Area)

LOCATION	Mean Concentrations of air pollutants measured								
	PM _{2.5} (µg/m ³)	PM ₁₀ (µg/m ³)	SO ₂ (µg/m ³)	HCHO (mg/m ³)	NO ₂ (µg/m ³)	CO (µg/m ³)	CO ₂ (ppm)	O ₃ (µg/m ³)	TVOC (mg/m ³)
BUSY ROAD	3.98	6.60	0.8900	0.0865	1.80	470.00	541.10	43.80	0.0532
GARAGE	6.30	9.60	0.0990	0.0895	2.61	544.30	538.00	38.20	0.0987
SCHOOL	4.95	7.55	0.0250	0.0301	1.22	402.20	482.70	40.66	0.0853
RESIDENTIAL ZONE	3.45	4.55	0.0654	0.0874	1.05	550.40	350.00	35.00	0.0645
HOSPITAL	3.90	4.15	0.4538	0.0542	2.33	454.60	544.00	36.10	0.0876
HOTEL	3.54	4.80	0.5435	0.0453	0.50	560.60	407.00	32.8	0.0658
MARKET	9.50	8.70	1.5532	0.6024	1.50	650.00	545.00	30.50	0.5686

Table 2-6 clearly show the concentration of the air pollutants present in the studied areas and locations. It was depicted that the concentration of all the pollutants was at the permissible limit set by World health organisation and Federal ministry of environment except in Okpoga, Otukpo, Oju and Ugbokpo. where HCHO and TVOC was higher than the limit probably because of poor ventilation, industrial and vehicular pollution, high temperature and humidity, combustion sources, new construction because of urbanization and other environmental factors. Unlike the research conducted by [15] where the level of air pollutants and particulate matter within Abuja metropolis, Nigeria was assessed and only carbon mono oxide (CO) was found to be higher than the permissible limit set by WHO and Nigerian National Ambient Air Quality Standards (Nigerian NAAQS)

Otukpo Local Government Area

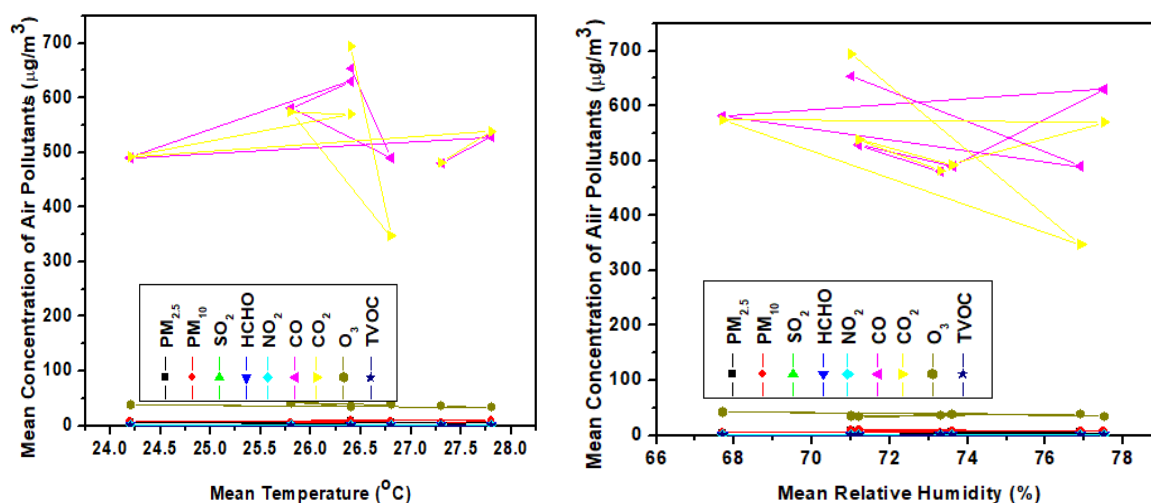


Figure 3: Graphs showing the Correlation and Relationship of the Data of the Parameters in Otukpo

The mean concentrations of some of the pollutants increases with the temperature while some just increase a little above the zero level. The concentrations of CO and CO₂ fluctuated with the temperature and relative humidity but within 350 to 700 µg/m³. The concentration of O₃ remained below 50 µg/m³ even for a fluctuated temperature and relative humidity values between (24.2 to 27.75 °C) and (68 to 78 %) respectively. The rest of the air pollutants such as PM_{2.5}, PM₁₀, SO₂, HCHO and TVOC just increased a little above the zero level for all values of temperature and relative humidity. This shows that only three (CO, CO₂ and O₃) of the air pollutants actually increased with temperature and relative humidity.

Oju Local Government Area

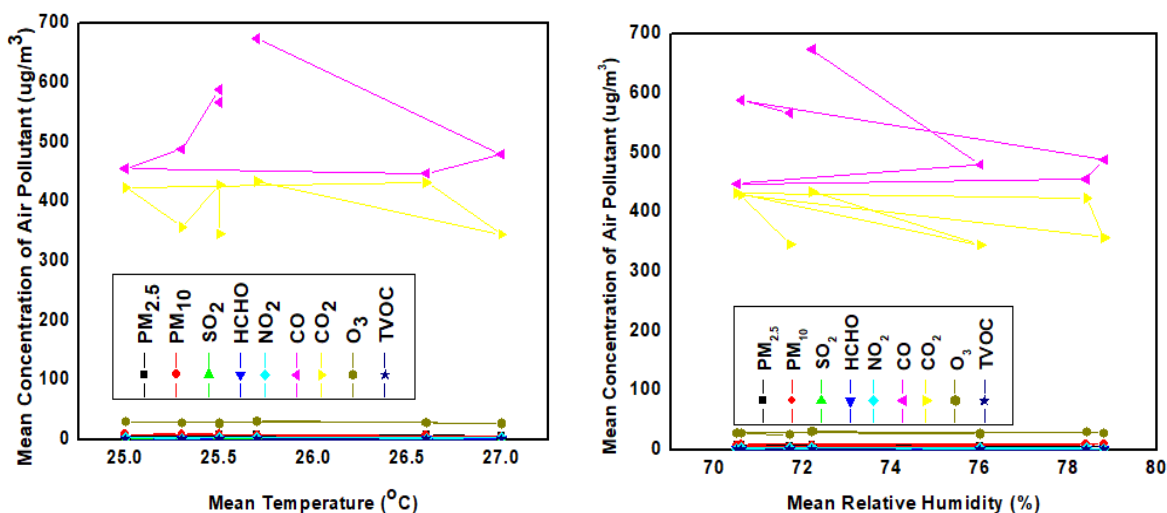


Figure 4: Graphs showing the Correlation and Relationship of the Data of the Parameters in Oju

The concentrations of CO and CO₂ fluctuated with the temperature and relative humidity but within 350 to 700 $\mu\text{g}/\text{m}^3$. The concentration of O₃ remained below 40 $\mu\text{g}/\text{m}^3$ even for a fluctuated temperature and relative humidity values between (25 to 27 °C) and (70.5 to 78.5 %) respectively. The rest of the air pollutants such as PM_{2.5}, PM₁₀, SO₂, HCHO and TVOC just increased a little above the zero level for all values of temperature and relative humidity. This shows that only three of the air pollutants (CO, CO₂ and O₃) actually increased with temperature and relative humidity.

Okpokwu Local Government Area

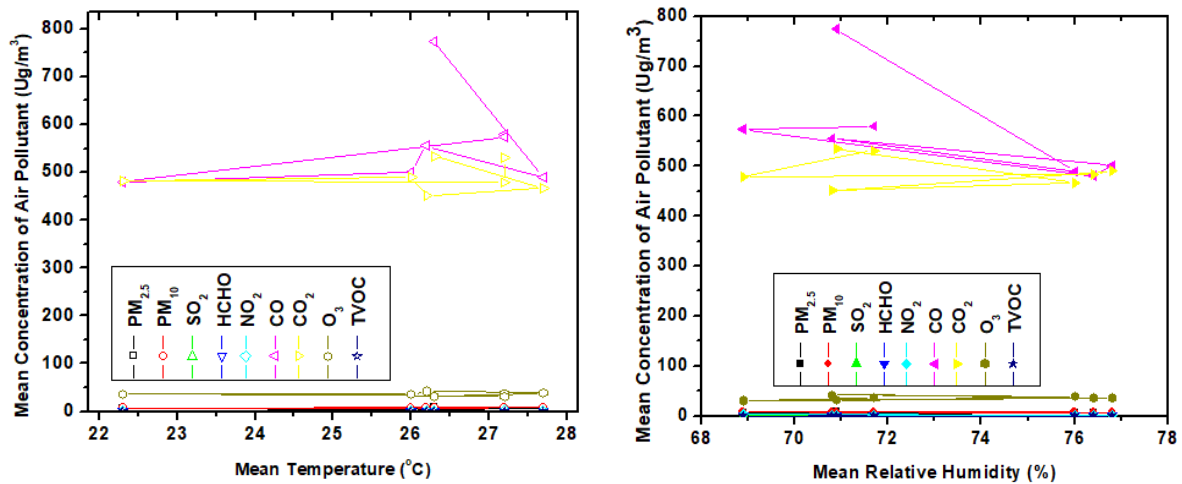


Figure 5: Graphs showing the Correlation and Relationship of the Data of the Parameters in Okpokwu

The mean concentrations of some of the pollutants increases with the temperature while some just increase a little above the zero level. The concentrations of CO and CO₂ fluctuated with the temperature and relative humidity but within 400 to 800 $\mu\text{g}/\text{m}^3$. The concentration of O₃ remained below 50 $\mu\text{g}/\text{m}^3$ even for a fluctuated temperature and relative humidity values between (22 to 28 °C) and (68.8 to 77 %) respectively. The rest of the air pollutants such as PM_{2.5}, PM₁₀, SO₂, HCHO and TVOC just increased a little above the zero level for all values of temperature and relative humidity. This shows that only three (CO, CO₂ and O₃) of the air pollutants actually increased with temperature and relative humidity.

Ogbadibo Local Government Area

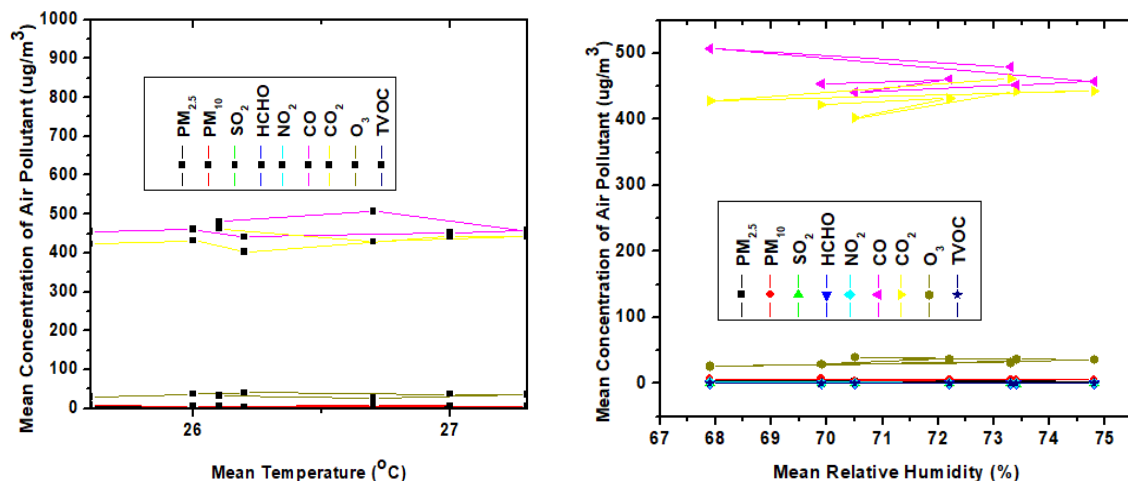


Figure 6: Graphs showing the Correlation and Relationship of the Data of the Parameters in Ogbadibo

The mean concentrations of some of the pollutants increases with the temperature while some just increase a little above the zero level. The concentrations of CO and CO₂ fluctuated with the temperature and relative humidity but within 400 to 500 $\mu\text{g}/\text{m}^3$. The concentration of O₃ remained below 50 $\mu\text{g}/\text{m}^3$ even for a fluctuated temperature and relative humidity values between (26 to 27 °C) and (68 to 75 %) respectively. The rest of the air pollutants such as PM_{2.5}, PM₁₀, SO₂, HCHO and TVOC just increased a little above the zero level for all values of temperature and relative humidity. This shows that only three (CO, CO₂ and O₃) of the air pollutants actually increased with temperature and relative humidity.

Apa Local Government Area

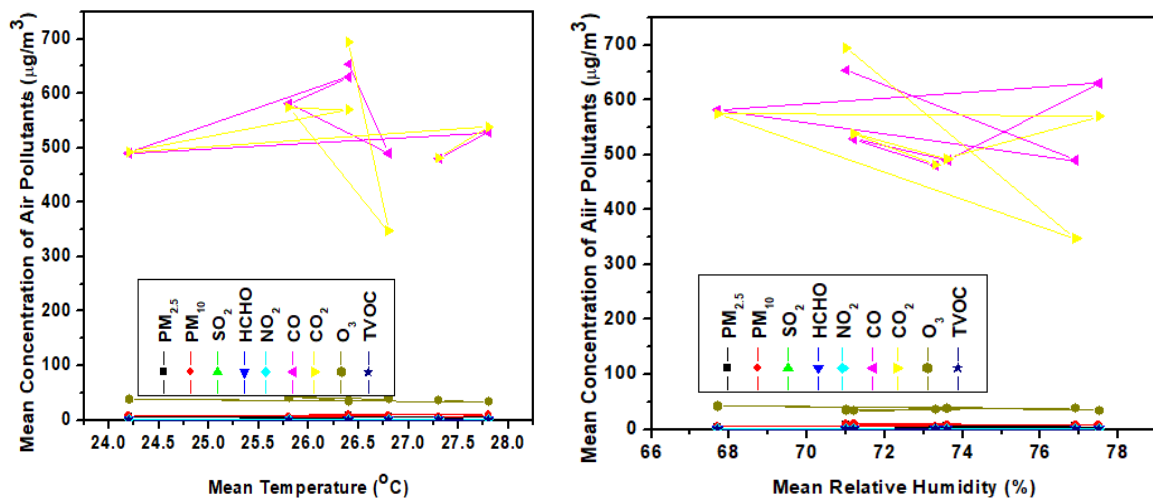


Figure 7: Graphs showing the Correlation and Relationship of the Data of the Parameters in Apa

The mean concentrations of some of the pollutants increases with the temperature while some just increase a little above the zero level. The concentrations of CO and CO₂ fluctuated with the temperature and relative humidity but within 300 to 700 $\mu\text{g}/\text{m}^3$. The concentration of O₃ remained below 50 $\mu\text{g}/\text{m}^3$ even for a fluctuated temperature and relative humidity values between (24.4 to 27.6 °C) and (67.8 to 77.6 %) respectively. The rest of the air pollutants such as PM_{2.5}, PM₁₀, SO₂, HCHO and TVOC just increased a little above the zero level for all values of temperature and relative humidity. This shows that only three (CO, CO₂ and O₃) of the air pollutants actually increased with temperature and relative humidity.

Table 7: Air Pollution Permissible Limit by Regulatory Bodies

REGULATORY BODY	PM _{2.5} ($\mu\text{g}/\text{m}^3$)	PM ₁₀ ($\mu\text{g}/\text{m}^3$)	SO ₂ ($\mu\text{g}/\text{m}^3$)	HCHO (mg/m ³)	NO ₂ ($\mu\text{g}/\text{m}^3$)	CO ($\mu\text{g}/\text{m}^3$)	CO ₂ (ppm)	O ₃ ($\mu\text{g}/\text{m}^3$)	TVOC (mg/m ³)
W. H. O	15	45	20	0.10	200	10,000	1,000	180	0.3
FMEEnv	35	50	125	0.10	200	10,000	1,000	180	0.3

KEY: W.H.O: World Health Organisation; FMEEnv: Federal Ministry of Environment [16, 17]

MEAN CONCENTRATION OF AIR POLLUTANTS

The results of air pollutants measure in the major towns in Benue zone C are presented in table 7-11. The concentration of $PM_{2.5}$ ranges from 1.96-9.50 $\mu\text{g}/\text{m}^3$ in the sampled areas, which is below the permissible limit set by W.H.O and FMEnv with the values 15 and 35 respectively as compared with table 13. That of PM_{10} ranges from 3.18-9.60 $\mu\text{g}/\text{m}^3$ as obtained from the sampled points is below the limit set by W.H.O and FMEnv as compared with table 13 with values of 45 and 50 respectively. The concentration of SO_2 ranges from 0.0065-1.5532 ($\mu\text{g}/\text{m}^3$) in the sampled locations is at the acceptable limit set by regulatory bodies as shown in table 13. The concentration of HCHO ranges from 0.0010-0.7102 (mg/m^3) in the sampled area, which is also at the permissible limit (0.10 mg/m^3) set by regulatory bodies except in some locations in Oju (School: 0.7102, Garage: 0.6160, Hospital: 0.6010, Busy Road: 0.4735, Hotel: 0.4057) Otukpo Market (0.6024), this may do to industrial emission, incomplete combustion of fuels in vehicle and biomass burning, indoor sources from building materials, furniture and other household products, oxidation of VOCs, Cigarette Smoking and Decomposition of Organic Matter. The concentration of NO_2 in the study area is at the range of 0.20-3.55 $\mu\text{g}/\text{m}^3$ which is at the set standard by regulatory body as indicated in table 13. The concentration of CO in the study area is at the permissible limit set by regulatory body as compare to the value in table 13 with the range 380.00-774.00($\mu\text{g}/\text{m}^3$). The concentration of CO_2 in the study area is at range of 414-674 ppm which is at the permissible limit set by regulatory bodies (1000 ppm). O_3 in the study area is at the range of 25.5-43.80 $\mu\text{g}/\text{m}^3$ which is at the limit set by regulatory bodies (180 $\mu\text{g}/\text{m}^3$). The concentration of TVOC is at the range of 0.0160-0.5686 mg/m^3 which is at the permissible limit set by regulatory bodies (0.3 mg/m^3) except in some locations in Ugbokpo (Busy Road: 0.3532 mg/m^3), Oju (Busy Road: 0.3658 mg/m^3), Okpoga (Busy Road: 0.4532 mg/m^3) and Otukpo (Market: 0.5686 mg/m^3). The increase in the concentration of TVOC observed in these locations may be due to; emission from industrial activities, traffic vehicle emission, Natural sources, chemical reactions in the atmosphere, waste management and landfills and environmental conditions.

V. CONCLUSION

In this study, comprehensive assessment of environmental air pollutions level was carried out in Benue Zone C, where five (5) local government areas were considered as a case study. Seven (7) selected areas were surveyed in the five (5) local government areas (Busy Road, Garage, School, Residential area, Hospital, Hotel, Market). The result shows that the concentration of air pollutions level is highest in the garage, Market and at the busy road and lowest at the school and hospital because of poor ventilation, industrial and vehicular pollution, high temperature and humidity, combustion sources, new construction because of urbanization and other environmental factors. This investigation reveals that the concentration of air pollution levels at all the locations surveyed are at the recommended limits set by regulatory bodies except the concentration of HCHO in some locations in Oju and Otukpo and the concentration of TVOC in some locations in Ugbokpo, Oju, Okpoga and Otukpo. Since HCHO and TVOC exceeded the permissible limit set by regulatory bodies in some local government areas (Otukpo, Oju and Okpokwu) which can pose serious environmental and health problems in the area, there is need for strict environmental rules to restrict the emission of HCHO and TVOC and Implementing public awareness programs on the dangers of air pollution.

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CONFLICT OF INTEREST

There was no conflict of interest in the cause of this research.

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