



Assessment of the Impact of Some Selected Quarry Sites on the Atmospheric Air Quality in Abuja Municipal Area Council, FCT, Nigeria

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Abstract

Abuja Municipal Area Council is one of the locations in Nigeria that is generally associated with environmental degradation resulting air quality depletion from unsustainable natural resources exploration activities like quarrying. Quarrying in some part of the study area is intense with a lot of associated gases released into the atmosphere. The aim of this paper is to assess the impacts of quarry sites on the atmospheric air quality in Abuja Municipal Area Council, FCT, Nigeria. The sources of data used include primary and secondary. The primary data include air pollutants samples, reconnaissance survey, questionnaire administration and oral interview. Secondary data were sourced from the gazettes, internet facilities, text books, journals, published and unpublished thesis from University library with regards to the impacts of quarry sites on the atmospheric air quality in Abuja Municipal Area Council, FCT, Nigeria. The methods of data analysis used include both qualitative and quantitative data analysis methods. The result shows that during the dry season, Wumba district ranked the highest in edges sample data with $900\mu\text{g}/\text{m}^3$ and the least was located in Garki village with $400\mu\text{g}/\text{m}^3$. In 750m away from the quarry sites, Wumba district and Dutse ranked the highest with $270\mu\text{g}/\text{m}^3$ while Garki village ranked the least with $120\mu\text{g}/\text{m}^3$. This revealed that PM_{10} values in dry season tends to decrease with distance away from the quarry sites of the study area. While during the rainy season, Guzape ranked the highest in edges sample data with $300\mu\text{g}/\text{m}^3$ and the least was located in Garki village with $180\mu\text{g}/\text{m}^3$. In 750m away from the quarry sites, Dutse ranked the highest with $70\mu\text{g}/\text{m}^3$ while Garki village ranked the least with $20\mu\text{g}/\text{m}^3$. This revealed that PM_{10} values in rainy season tends to decrease with distance away from the quarry sites of the study area. The finding also shows that

decrease agricultural yields ranked the highest with 40%, yellowish of some agricultural plant leaves ranked second with 29.3%, destruction of farmlands ranked third with 21.3% and inadequate germination of agricultural seeds ranked the least with 9.4% of the respondents. This shows that the major impact of quarry air pollutants on agricultural activities was decrease agricultural yields. An understanding of the source of the air pollutants is very important in the control and prevention of atmospheric emissions especially from point sources. The paper discovered that there was significant disparity in the observed concentrations of the atmospheric pollutants under consideration at different times within the study location. The study observed remarkable spatial and temporal variations of PM₁₀, CO, VOC, SO_x and NO_x across the study area. The values of PM₁₀, CO, NO_x and SO_x showed elevated concentrations of these pollutants in the dry season when compared with rainy season, indicating significant anthropogenic inputs which may include higher vehicular movement, quarrying activities and emissions due to industrial activities within the study area.

Keywords: *Quarry sites, Air quality, Quarrying and AMAC*

Introduction

The process of getting useful stone from a quarry is known as quarrying. The methods and equipment used in quarry depend on the purpose for which the stone is extracted. Different quarrying activities have different impacts on air quality (Alaturca, 2012). The process of making holes in rock, limestone or overburden with the aid of a drilling machine (drilling process) may be treated as a point source of pollutant emission. Shattering the drilled limestone or overburden in a bid to loosen the mass in smaller fragments (blasting process) may be treated as an instantaneous point source for suspended particulate. Also, the loading and movement of dumper trucks on haul routes would generate suspended particulates while the crushing of ore and transferring it to a belt conveyor

(ore processing) would be a potential source of dust generation. Loading and movement of vehicles may be treated as point and line sources (Daramola *et al.*, 2014).

Mineral exploration, mining and processing have resulted in environmental damages including ecological disturbance, destruction of natural flora, pollution of air, land and water, instability of soil and rock masses, landscape degradation and radiation hazards (Aigbedion & Iyayi, 2017). Dust is the main source of air pollution in quarry industry. The extent of pollution by dust depends on the local microclimate conditions, the concentration of dust particles in the ambient air, the size of the dust particles and their chemistry (Hsin-Yi, 2012). Dust has effect both on

human health and the natural environment. It can lead to chronic health effects for instance decreased lung capacity and lung cancer resulting from long-term exposure to toxic air pollutants (Sunyer, 2011). However, it blocks and damages the internal structure and abrasion of leaves and cuticles (Hsin-Yi, 2012). The number of quarrying industries in FCT, Nigeria is kept on increasing. Although it contributes to the internally generated revenue, there is need to look at its effect on the neighbouring communities and the environment in general. Work has been done on the levels of heavy metals in soil and vegetation of a quarry site and on the level of suspended particulates in the ambient air and around selected quarry sites (Oguntoke *et al.*, 2015).

Environmental pollution mainly resulting from atmospheric emissions has become a major and serious environmental issue of great concern in most Nigerian cities. This has become more worrisome due to the increase in sources and the diverse nature of the anthropogenic and fugitive atmospheric pollutants from quarrying activities. The level of these atmospheric pollutants in an area is generally influenced by various factors such as concentration, circulation of the local emission sources as well as environmental and the prevailing meteorological factors (Ogba, 2016). The emission of these pollutants increases the overall toxic burden of the environment, as well as deteriorate the ambient air quality (Opara *et al.*, 2016). The tendency for the release of toxins from atmospheric emissions to the environment is therefore influenced by these factors mentioned above. There is need therefore to carry out regular monitoring and analysis of these atmospheric emissions in the study area. The need for this paper was necessitated by the fact that Nigeria like most developing countries have inadequate continuous air quality monitoring stations, hence inadequacy of air quality data base. There is paucity of air quality reports on atmospheric emissions in the study area. This is because there is a dearth of data on atmospheric emissions in FCT Abuja in particular and Nigeria in general. The need for regular monitoring of the air quality of this area is not only crucial for air quality protection but also very important for accurate planning and execution of environmental pollution mitigation policies. Abuja Municipal Area Council is one of the locations in Nigeria that is generally associated with environmental degradation resulting air quality depletion from unsustainable natural resources exploration activities like quarrying. Quarrying in some part of the study area is intense with a lot of associated gases released into the atmosphere. There are other potential sources of gaseous emission in the study area which includes emissions from quarrying activities within Abuja Municipal Area Council (AMAC) of FCT, high vehicular traffic mainly from fairly used vehicles, power generating sets, unsustainable agricultural practices like bush burning as well other anthropogenic activities. The aim of this paper is to assess the impacts of quarry sites on the atmospheric air quality in Abuja Municipal Area Council, FCT, Nigeria.

AMAC is an area council which falls within latitude 8° 56'44 N and 9° 06'18 North of the Equator and longitude 6°40'13 E and 7°42'41 E. The Abuja Municipal Area Council is the

local government responsible for administration of the city and has a population of about 776,298 in the year 2020. It is bound to the north by Bwari Area Council (AC), to the east by Karu AC, to the south by Kuje AC, to the west by Gwagwalada AC, and southwest by Nasarawa LGA in Nasarawa State. This region has an area of approximately 1456 km². It is regarded as the Capital City and is the centre of most commercial and governmental agencies.

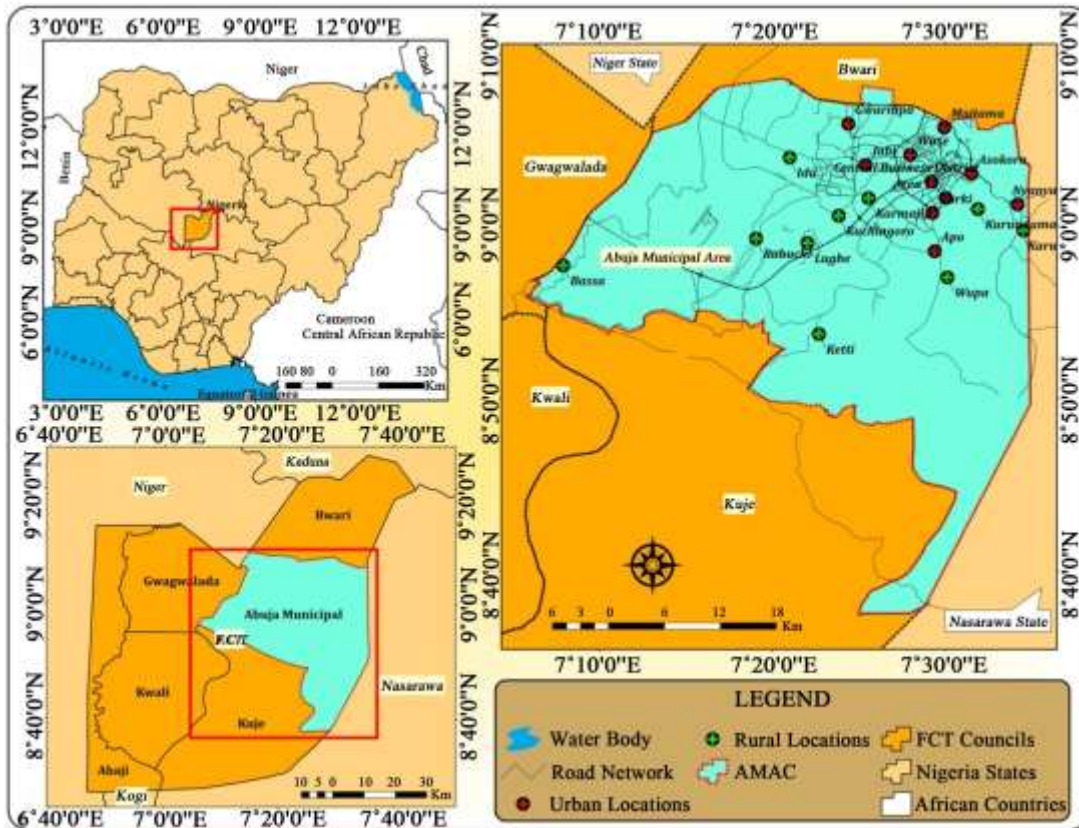


Figure 1: Location of Abuja Municipal Area Council (FCT, Nigeria)

Source: Federal Capital Development Authority (2022)

Materials and Methods

The sources of data used include primary and secondary. The primary data include air pollutants samples, reconnaissance survey, questionnaire administration and oral interview. In order to develop detailed and comprehensive literature review, the information were obtained from written documents. To achieve this therefore, data were sourced from the gazettes, internet facilities, text books, journals, published and unpublished thesis from University library with regards to the impacts of quarry sites on the atmospheric air quality in Abuja Municipal Area Council, FCT, Nigeria. The methods

of data analysis used includes both qualitative and quantitative data analysis methods. The Data analysis was analysed utilizing SPSS 20.0.

Results and Discussion

The ranges for samples collection were the edge of the sites, 250m, 500m and 750m away from the sample sites. Wumba district ranked the highest in edges sample data with $900\mu\text{g}/\text{m}^3$ and the least was located in Garki village with $400\mu\text{g}/\text{m}^3$. In 750m away from the quarry sites, Wumba district and Dutse ranked the highest with $270\mu\text{g}/\text{m}^3$ while Garki village ranked the least with $120\mu\text{g}/\text{m}^3$. This revealed that PM_{10} values in dry season tends to decrease with distance away from the quarry sites of the study area.

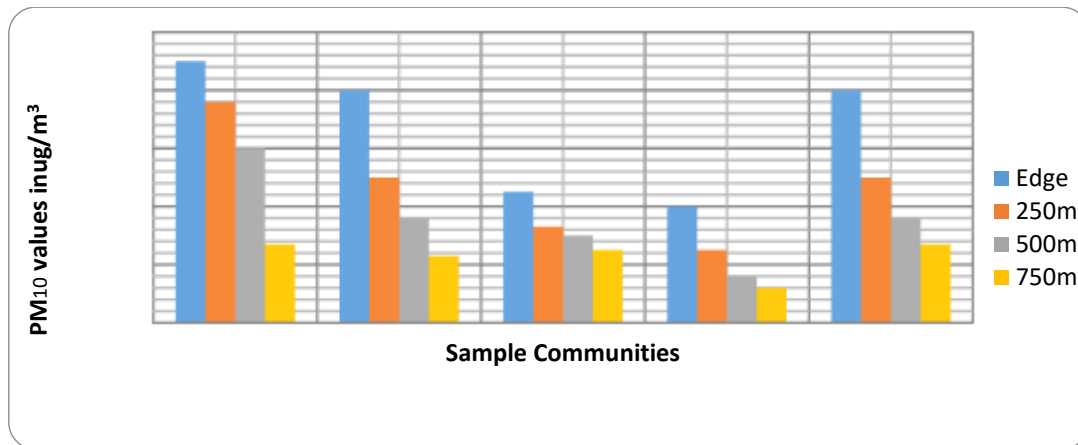


Figure 2: Dry Season PM_{10} values across the Sample Communities

Figure 3 shows the rainy season PM_{10} values across the sample communities. Guzape ranked the highest in edges sample data with $300\mu\text{g}/\text{m}^3$ and the least was located in Garki village with $180\mu\text{g}/\text{m}^3$. In 750m away from the quarry sites, Dutse ranked the highest with $70\mu\text{g}/\text{m}^3$ while Garki village ranked the least with $20\mu\text{g}/\text{m}^3$. This revealed that PM_{10} values in rainy season tends to decrease with distance away from the quarry sites of the study area.

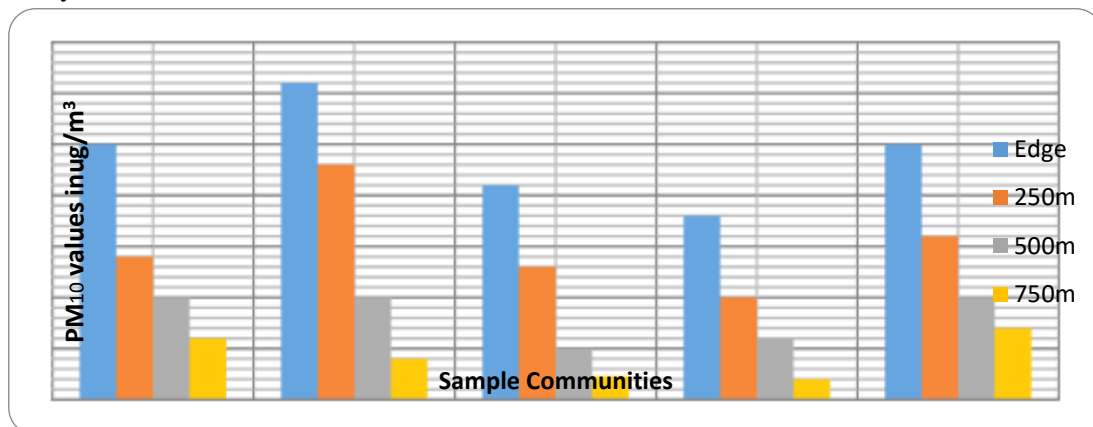


Figure 3: Rainy Season PM₁₀ values across the Sample Communities

The PM₁₀ values in dry season were much higher when compared with that of rainy season as revealed in Figure 2 and 3 of the study. The major reason behind the difference was strength of the wind speed.

From Table 1, 24.7% reported prevalence throat infections, 46.3% of the respondents clamor the prevalence of cough/catarrh, 6.5% of the total respondents reported the issue of heart diseases, 19.0% reported chest aches and 12.8% reported the prevalence of Skin infections. The pollution produced from quarry activities affect the health of people living very close to the site thereby making live difficult to the residents.

Table 1: Health Challenges Associated with Quarry Activities in the Study Area

| Health Challenges | Frequency | Percentage (%) |
|-------------------|-----------|----------------|
| Throat infections | 87 | 24.7 |
| Cough/catarrh | 163 | 46.3 |
| Heart diseases | 23 | 6.5 |
| Chest aches | 67 | 19 |
| Skin infections | 45 | 12.8 |
| Total | 352 | 100 |

Source: Field Survey (2022)

As revealed in Table 2, decrease agricultural yields ranked the highest with 40%, yellowish of some agricultural plant leaves ranked second with 29.3%, destruction of farmlands ranked third with 21.3% and inadequate germination of agricultural seeds ranked the least with 9.4% of the respondents. This shows that the major impact of quarry air pollutants on agricultural activities was decrease agricultural yields.

Table 2: Impacts of Quarry Air Pollutants on Agricultural Activities in the Study Area

| Options | Frequency | Percentage (%) |
|--|-----------|----------------|
| Inadequate germination of agricultural seeds | 33 | 9.4 |
| Yellowish of some agricultural plant leaves | 103 | 29.3 |
| Destruction of farmlands | 75 | 21.3 |
| Decrease agricultural yields | 141 | 40 |
| Total | 352 | 100 |

Source: Field Survey (2022)

Conclusion

An understanding of the source of the air pollutants is very important in the control and prevention of atmospheric emissions especially from point sources. The paper discovered that there was significant disparity in the observed concentrations of the atmospheric pollutants under consideration at different times within the study location. The study observed remarkable spatial and temporal variations of PM₁₀, CO, VOC, SO_x and NO_x across the study area. The values of PM₁₀, CO, NO_x and SO_x showed elevated concentrations of these pollutants in the dry season when compared with rainy season, indicating significant anthropogenic inputs which may include higher vehicular movement, quarrying activities and emissions due to industrial activities within the study area.

The pollutions affect the health of the people living very close to the sites thereby making live difficult to the residents. It was discovered that majority of all that are residing within jurisdiction of less than 1km are vulnerable to different types of pollution such as, Noise, Air (Dust), Water and Land pollution which is one of the root cause of the health challenges faced by the residents of the study area. The assessment results revealed that the concentration of PM₁₀ of some locations were above air quality index (AQI) limits set by WHO especially at the business district. This results from the assessment indicates that most the population leaving around the business district are exposure to high level of pollution. The research outcome demonstrates that the particulate matter pollution situation is not favorable in the study area as there exhibit a wide gap between assessment result of particulate matter concentration and the WHO set standards. The health risk indicates some locations in the study area are unsafe for sensitive, unhealthy and very unhealthy for agricultural practices. It's recommended that the regulatory and enforcement agency needs to reexamine current regulation on air quality monitoring as well as develop a more robust monitoring mechanism, regulations and enforcement to determine the most effective and efficient way to improve the air quality.

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