AIR POLLUTANTS IMPACT ASSESSMENTAND SIMULATION ANALYSIS OF SOME SELECTED BUSY LOCATIONS OF BAUCHI METROPOLIS

Dauda B. S[a]., Chindo I. Y[b],Shibdawa M. A[b]., Adamu H. M[b]., Emmanuel S. W[c]., Chioma U.O[a].
[a]College of Education KangereBauchi., AbubakarTafawaBalewa University Bauchi.,
[c]Borno State Environmental Protection Agency.
butehdauda@gmail.com Mobile No : 08189583373

Abstract: Gaseous samples were collected from some sampling points 200 – 400 m apart in Bauchi metropolis. Control samples were also collected from Dass town about 47 kilometres away from the study area. The samplings were carried out in dry and wet seasons using Gas samplers which contained adsorption devices of about 5 cm long, packed with activated charcoal and hydrogen peroxide (H2O2). The samplers were hung on poles at the sites designated for the study. Trapped gaseous pollutants were leached from the adsorbents with hydrogen peroxide and after treatment, the pollutants were analysed with UV/visible – Spectrometer (model cecil 1000 series), at 320nm. Of the two criteria air pollutants analysed (CO2,and CO,), Carbon dioxide had the highest concentration 3.73ppm (+0.02). However, CO2, and CO were within the permissible limits of FEPA (2001) and USEPA (2008).

Key words: Bauchi, Gas Samplers, adsorbents, pollutants and Uv/ Visibble – Spectrometer.

INTRODUCTION

Air is one of the most important constituents of man's environment. An average human being requires about 12kg of air each day, which is nearly 12 to 15 times greater than the amount of food consumed Garg*et al*. (2006). Clean and pure air is very essential for human health and survival. Any change in the natural and normal composition of air may adversely affects the living system, particularly the human life Garg*et al*.(2006).

Air pollution is generally defined as the presence in the outdoor atmosphere of one or more contaminants such as fumes, dust, gases, mist, odour, smoke, smog or vapours in considerable quantities and duration of which is injurious to human, animal and plant life or which unreasonably interferes with the comfortable enjoyment of life and property (Anjaneyulu, 2005).

Thus air pollution is generally disequilibrium condition of air caused by the introduction of foreign elements from natural and manmade sources to the air so that it becomes injurious to biological communities (Anjaneyulu, 2005).

The World Health Organization (WHO) defines air pollution as limited to situations in which the outer ambient atmosphere contains materials in concentrations which are harmful to man and his environment (Anjaneyulu, 2005).

A substance in the air that can cause harm to humans and the environment is known as an air pollutant and air pollutants are expressed as a ppm or ug/m^3 which is subjected to change to variations of temperature and pressure (Das and Behera, 2008).

Air pollution is a problem that is directly related to the number of people living in an area and the kinds of activities they engaged in. In a place where the population is low and their energy usage is also low, the impact of people in creating pollution is minimal. However where the

population is high, like in urbanized and industrialized areas with high energy usage, large quantities of pollutants are released into the environment. It is clearly obvious that the greater the concentration of people in one area, the greater the amount of pollution and the greater the sophistication of a society the more intricate and poignant its pollution (Inyang, 1978).
This research is aimed at assessing the impact of air pollutants(CO, and CO_2,) at some selected busy locations of Bauchi metropolis Nigeria.

MATERIALS AND METHODS

Sampling Points

The sampling points include Yankari park (YKP), Railway park (RM) and Gwallagastreet (GS), respectively with Dass town (DT)as the control point.

Gas Sampler

The absorption devices used contained adsorption cells about 5 cm long, packed with activated charcoal and hydrogen peroxide, these were housed in plastic tubes. Funnel like plastic structures 12 cm in diameter were connected to the tubes for gas passage into the adsorption devices. The samplers were hung on poles from 8:30 am – 4:30 pm at the locations selected for the study. The desired gaseous pollutants were collected as they came in contact with the adsorbent. The amount of pollutants adsorbed areproportional to the surface area, temperature of the adsorbent and the pressure maintained in the sampling train. The adsorbates were subsequently leached from the adsorbent using hydrogen peroxide solution and the samples after treatment were analyzed with UV/VIS Spectrometer at 320nm (Model Cecil 1000 series).

Uv/Visble Spectrometric Analysis

CO- CO_x measurement

This measurement adopts the method of molybdenum blue (Fankhauser, 1993).The solution was reacted with 1% silica molybdate to form molybdenum blue and the colour changes from yellow to green and then to permanent blue this was gradual, that is 2 - 3 drops of silica impregnated with ammonium molybdate in sulphuric acid was reacted with carbon monoxide to give a blue solution, then the gas sample was then analysed with a UV/VIS spectrometer at the wavelength of 320nm.
The results obtained from the analysis are indicated in figures1a- 2c below and concentrations were compared with permissible limits of FEPA and USEPA respectively.

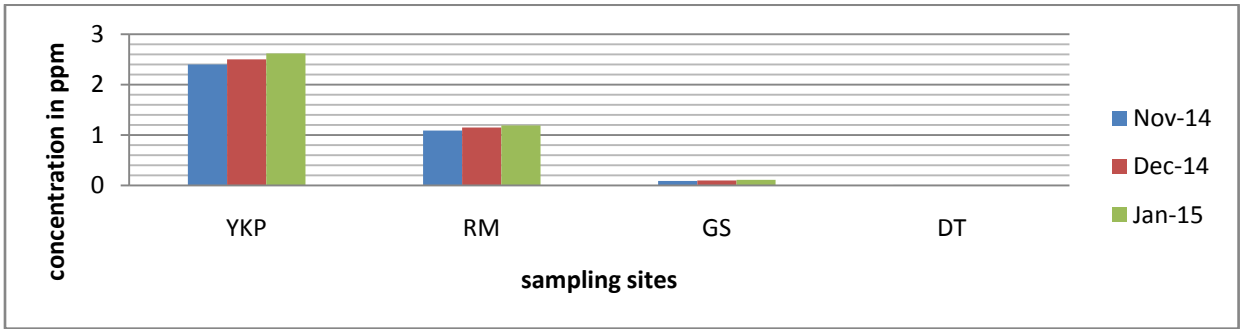

Fig 1a : UV/Visible – Spectrometric Analysis of CO_2 for Hamattan at Parks, Markets and Streets (Nov14 – Oct15). YKP = yankari park, RM = railway market, GS = gwallaga street

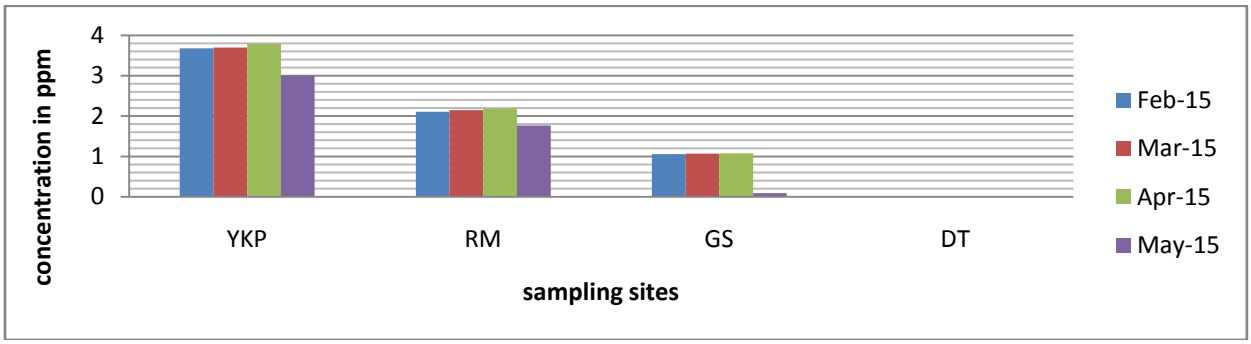

Fig 1b : UV/Visible – Spectrometric Analysis of CO_2 for Dry Seas. at Parks, Markets and Streets (Nov14 – Oct15). YKP = yankari park, RM = railway market, GS = gwallaga street

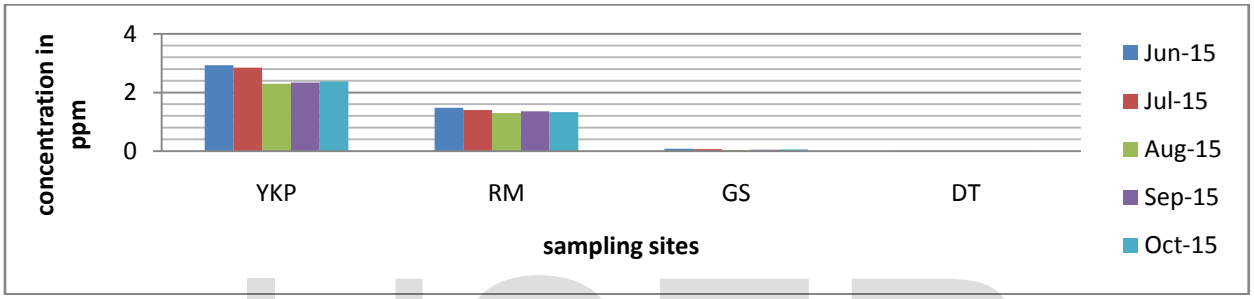

Fig 1c : UV/Visible – Spectrometric Analysis of CO_2 for Wet Seas. at Parks, Markets and Streets (Nov14 – Oct15). YKP = yankari park, RM = railway market, GS = gwallaga street

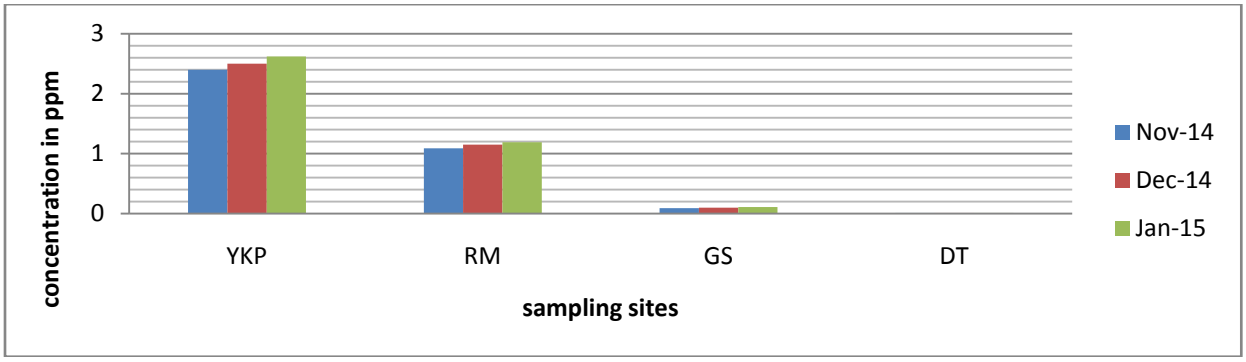

Fig 2a : UV/Visible – Spectrometric Analysis of CO for Hamattan at Parks, Markets and Streets (Nov14 – Oct15). YKP = yankari park, RM = railway market, GS = gwallaga street

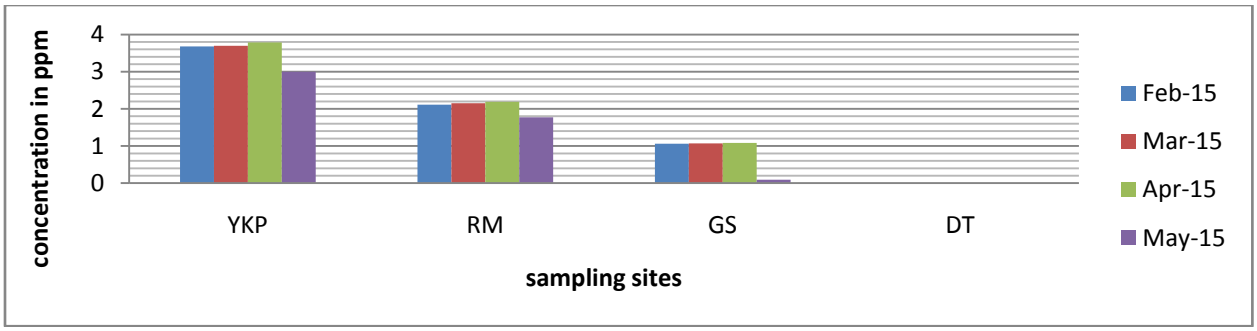

Fig 2b : UV/Visible – Spectrometric Analysis of CO for Dry Seas. at Parks, Markets and Streets (Nov14 – Oct15). YKP = yankari park, RM = railway market, GS = gwallaga street

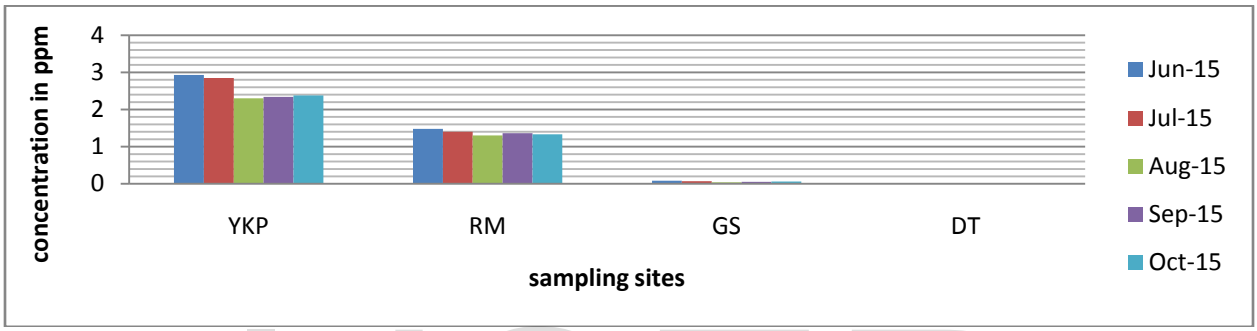

Fig 2c : UV/Visible – Spectrometric Analysis of CO for Wet Seas. at Parks, Markets and Streets (Nov14 – Oct15). YKP = yankari park, RM = railway market, GS = gwallaga street

DISCUSSION

In the course of this research, it was observed that the concentration levels of pollutants in the ambient air is influenced by metrological and anthropogenic factors. For instance, at Yankaripark (YKP) from November 2014 – January 2015, the concentration level of pollutants was affected by hamattan which does not favours the accumulation of gaseous pollutants in the atmosphere. Concentrations recorded in within the period were 2.38ppm, 2.47ppm, 2.59ppm, for CO_2.While CO recorded 1.37ppm, 1.49ppm, 1.54ppm at this period. But the months of Febuary 2015 to May 2015, which were intense dry season the concentration levels of the pollutants were favoured by increased temperature and the concentration recorded prevailed over that of the hamattan. This period recorded the following concentrations for the two criteria air pollutants. CO_2 : 3.66ppm, 3.68ppm, 3.77ppm, 2.97ppm, CO : 2.59ppm, 2.62ppm, 2.66ppm, 2.15ppm respectively. Wet season proceeded from June 2015 – October 2015, rain affected the concentrations of pollutants, as a result of the washing effects it has on the ambient air which led to decline in concentration levels of these pollutants. CO_2 recorded the following concentrations 2.91ppm, 2.83ppm, 2.27ppm, 2.31ppm 2.36ppm. CO had 1.13ppm, 1.07ppm, 1.01ppm, 1.05ppm, 1.23ppm. as shown figures 1a to 2c. The various anthropogenic activities through the use of variety of products such as cars, gasoline generators, wood and some petrochemicals lead to the emission of different chemicals into the environment. These chemicals release gases into the ambient air, thus increasing the concentration levels of photochemical oxidants. The elevated level of CO_2 as shown in this research especially in terms of occupational health of operators at the parks is worrisome, although consistent with results obtained from previous works (Bean and Butcher, 2006; Ajao, 2000). Elevated concentration levels of CO_2 could lead to respiratory problems and may cause distress to asthmatics. The findings of this research that particulate

matter and other coarse materials (fly ash, dust) are deposited close to the parks, markets and streets within a distance of 0 to 70m were consistent with observations of Abulude (2006) in his studies on sampled gases in the South Western Nigeria. It was also observed that vehicle exhaust and municipal solid wastes that constitute two-thirds of total emissions from the afore mentioned sources are not properly disposed off, corroborating the findings of Bello and Miginyawa (2010) from studies on the environment. Consequently, the release of these gases through open incineration can lead to the production of high concentration levels of the criteria air pollutants under investigation. The mean concentration level of CO_2 to the tune of 3.00ppm, 3.68ppm, 3.70ppm and 3.79ppm for dry season at the parks is within the recommended standard of 20.00ppm FEPA (2001) and 22.00ppm USEPA (2008). This situation dispels any adverse implications on the health of people in the study area. However, continuous emission and accumulation of CO_2 may cause throat and lung irritation, bronchitis and possibly premature death (Karr *et al.,* 2007). Ostro*et al.*(2007) found stronger and more frequent association between mortality and CO_2 components during dry season when, according to them, these components have higher concentrations in dry season the averages were roughly twice those of wet season. Results from this study concur with the above findings as high concentration levels of CO_2 were recorded during dry season than during cold and wet (rainy) season in the area. The torrential rains that characterize the wet season accompanied with strong southerly winds all help to dilute and disperse to a large extent, the concentration levels of gases in the ambient air. It may also be of interest to comment on the high level of CO_2 emissions in the area, with a maximum value of 3.79ppm that is far below the reference standard of 20ppm and 22ppm in terms of its contribution to global warming. Open burning of municipal solid wastes contributes to high carbon intensity, through high emission of CO_2 and CO that can amplify the potential for global warming (Masters, 2006).

Conclusion

This study assessed the impact of pollutants on ambient air quality in Bauchi metropolis. Results revealed that air quality is vitiated by various activities in Bauchi metropolis such as the burning of wastes, use of different chemicals and petrochemical products, gasoline generators and small / medium scale industries. Open burning of wood wastes, and heavy consumption of fossilized fuels (gasoline and diesel) to power various machines. Some of the gaseous pollutants monitored exceeded established standards for them. Results also showed a strong association between the identified gaseous pollutants.However, the overall assessment of air quality in the area indicated a result that would be described as healthful; meaning that the general health of the citizens at the study area is relatively safe. The level of emissions could further be mitigated by proper disposal of wastes, use of activated carbon, adoption of biofiltration, change in the use of fuel, by the implementation of Nuclear power plants which are relatively pollution free when compared to the coal fired powered plants. Cottage industries can be set up to make use of high volume of wastes generated as raw materials. For example, municipal solid wastes can be used to produce manure and particle boards, or moulded into small sizes and sold to households as domestic fuel. wastes can also be used for composting biogenic wastes to produce excellent materials used for soil conditioning. All these would help to reduce the level of emissions resulting from open burning of these waste materials and create jobs in the area.

REFERENCES

Abulude, F.O., (2006). **Analysisofsuspended air particulates in four sawmills in Nigeria.Texas Mission onEnvironmental Quality**. pp 20.

Ajao, E.A. (2000). **Land-based sources of pollution in Nigeria. Quantification of air pollution in some coastal cities. In: Air pollution and industrialization in Nigeria (A. Amadied).CCDI-Ecology and Dev. Series**, **1**: 20-34.

Akunne, A.F., Louis V.R., Sanon M., Saverborn R. (2006). Biomass solid and acute respiratory infection: the ventilation factor. *Int. J. Hyg. Environ. Health***209**: 445- 450

Anjaneyulu, Y. (2005). **Introduction to Environmental Science BS Hyderabad India**.**38**; 12 – 14.

Bello, S.R. and Miginyawa (2010).Assessment of air pollution in small scale sawmill industry of Southwestern Nigeria. *The C.L.G.R. journal of scientific research and development.***1558** (11): 2 - 10.

Das, R.C. and Behera, D. K. (2008) Environmental Science Principles and Practice Prentice Hall of India New Delhi India. Pp. 65-70.

Dubinskii, M. (2002).Ultraviolet Spectroscopy and UV Lasers. New York: Marcel Dekker. ISBN 0-8247-0668-4. Pp. 265-268.

Garg, S. K., Garg, R. and Garg, R. (2006), **Environmental Science and Ecological Studies**. Delhi, Khanna Hyderabad India. **54**, (56); 7 – 9.

Federal Environmental Protection Agency (2001). **National Guidelines for Environmental Audit in Nigeria. Abuja: Fed. Govt. Press.** Pp. 12-13.

Inyang, P. (1978). *Environmental Pollution in some Nigerian Towns In Urbanization Processes and Problems in Nigeria* (Sada,P.O.andOguntoyinbo,J.S. Eds) Ibadan University Press.

Karr, C., Lumley, T., Schreuder, A., Davis R., Larsson, T., Ritz, B. (2007).Effects of sub-chronic and chronic exposure to ambient air pollutions on infant bronchiolitis.A.M.J. *Epidemol* (16): 553-560.

Ostro, B., Feng, W., Broadwin, Green, S., Lipsett, M. (2007). The effects of components of fine particulate air pollution on mortality in California: Results from California. *Environ Health Journal***115**:13-19.

Stanley, A.M., Mbamali, I. and Dania, A. A. (2010).Effect of fossil-fuel electricity generators on indoor air quality in Kaduna Nigeria. Retrievedfrom www.abu.ng/publications/2012-03-30

United States Environmental Protection Agency (1994). **National Air Quality and Emissions Trend Report,** EPA-454/R-94-026 **Environmental Protection Agency Washington DC.**Pp. 2-7.