AIR POLLUTION IN A SAWMILL INDUSTRY: THE OKOBABA (EBUTE- META, LAGOS) EXPERIENCE

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Abstract

Burning as a means of disposing sawdust, a by – product of wood in the sawmill industry has raised a lot of environmental concern. The level of air pollution in Okobaba sawmill industry was investigated using standard and approved methods. Results from this study showed that CO levels ranged from 30 – 720ppm, NO_2 was 0.73 – 0. 84ppm and SO_2 were 0.23 – 0.60ppm. These values far exceed approved limits by the Federal Ministry of Environment. This is an indication that the inhabitants both living and working in the area as well as the ecosystem must have being adversely affected.

Keywords: Air pollution, Air pollutants, Air analyzer, Air quality index, Ecosystem, Sawmill Industry, Toxicity.

INTRODUCTION

The atmosphere consists of mixture of gases that completely surround the earth. Air is said to be polluted when chemicals, gases, particulate matter and biological materials that can cause harm or discomfort to humans or other living organisms or cause damage to the environment are released into the atmosphere (Akpanisi, 2003). Air pollution is the most insidious of all forms of pollution because we can partially avoid the direct contact of other forms of pollution; we must breathe the air (Dix, 1981; Speeding, 1997). The sources of these pollutants can be natural (volcanic eruptions, swamps, sea spray or forest-fires) or anthropogenic (emission from industries, power generation facilities, vehicle emission, quarry sites emission, gas flaring or burning of woods and carbonaceous materials (Speeding, 1997). Air pollutants arising from human activities can emanate from stationary sources or from mobile source such as mobile vehicles, ship and airplanes.

Air pollution of the urban centers is one of the world's worst pollution problems. The ambient air quality of an area affects the chemistry of its atmosphere and the general wellness of the environment including humans. Air quality reports in most advanced countries are therefore presented regularly to assist the public in the management of their health. Many industrialized countries have air quality standards and guidelines to regulate emission into the environment (USEPA, 1993; FGN, 1988). The pollution constituents that are emitted into the atmosphere are either gases or particulate matter such as smoke, aerosol, dust, fumes, grit, mist, fly ash, soot, etc. Chemical substances discharged into the atmosphere are called

pollutants when these undergo chemical change they are referred to as secondary pollutants. The effect of air pollution is upon the soil, vegetation, crop, animal life, people, buildings and structures.

Air pollutants include CO, NOx, CO_2, SO_2, H_2S, and VOCs. CO is one of the criteria pollutants because of its potential effects; it is produced during the incomplete combustion of fuels such as natural gas, coal or wood. CO combines with the red blood pigment called haemoglobin displacing oxygen and carboxyheamoglobin is formed (Raaschou- Nelson, 1995).

$$Hb + O_2 \rightarrow HbO_2$$

$$HbO_2 + CO \rightarrow HbCO + O_2.$$

The affinity of CO for haemoglobin is about 220 times greater than that of oxygen (Horsfal, 1998). People exposed to 80ppm of CO have their blood carrying capacity reduced by 15% which is roughly equivalent to losing a pint of blood and an acute concentration of 100ppm or more is invariably fatal. CO is an asphyxiate; prolonged exposure results in tissue damage. At extremely high level, CO can cause death (Raaschou-Nelson; 1995; Speeding, 1997).

NOx: This implies the oxides of nitrogen; Nitrogen (IV) oxide, one of the NOx is produced from vehicle exhaust systems, power generating systems and some chemical manufacturing processes. Like ozone, it can be formed by photochemical action and so is present in photochemical smog. The gas when inhaled forms HNO_2 and HNO_3 which attack the mucus inner lining of the lung, causing irritation of the throat, (Howel, 1997; Speeding 1997), fibrosis (scarring) and emphysema (distension). Acid rain by NOx gases leads to deterioration of buildings and structures.

SO_2 gas is an acidic gas which combines with water vapour and is implicated in the damage and destruction of vegetation, degradation of soils, building materials and water courses. People exposed to it have suffered respiratory symptoms such as nasal – pharygnities, coughing, shortness of breath (Akeredolu, 1989).

Several research works on air pollution and their related health hazard had been published (Ede et al., 2010, Ukpebor and Ahonkhai, 2002, Ayodele and Emmanuel,2007, Ayodele et al., 2007, Ugwu and Ofomatah, 2011, Uzoekwe et al., 2008).

The sawmill industry remains the backbone of furniture factories which has sustained many Nigerian families and has provided investment opportunities because of its high profitability due to the abundance of its raw materials. This has led to the improvement of the socio-economic development and empowerment of its workers (Okigbo, 1963,1964).

The Okobaba Sawmill Industry is located at Ebute Meta, in the Mainland of Lagos State of Nigeria, close to the Third Mainland Bridge that connects the Mainland to the Lagos Island. The sawmill sources its wood from the various forests in and around Lagos and are transported by rafting through the Lagos lagoon to the sawmill for processing to sawn wood, plywood etc. Massive amount of sawdust are generated as a result of the sawmill activities and to reduce the mountain of this sawdust, the millers resort to continual burning which causes great environments impact on the inhabitants within its vicinity. These include pollution by particulate matter from sawdust, thick heavy smoke from burning of the sawdust, the foul smell from logs of wood submerged in the lagoon awaiting processing etc.

The aim of this study, therefore, is to assess the index of air pollution around the Okobaba sawmill and to correlate this index with the burning of the sawdust and its consequent impact on the ecosystem of the area.

Materials and Methods

Air Pollution Test Equipments

All testing methods in each output follow the accepted procedures of the Environmental Protection Agency which recommends collection of the gas in a special absorbing solution and the subsequent chemical analysis. This gives better quantitative results than those obtained by gas indicator tubes or length of stain methods. The instrument used is the LaMotte Air Pollution Test Equipment Model AM-62 (5960) and the method is essentially colorimetric.

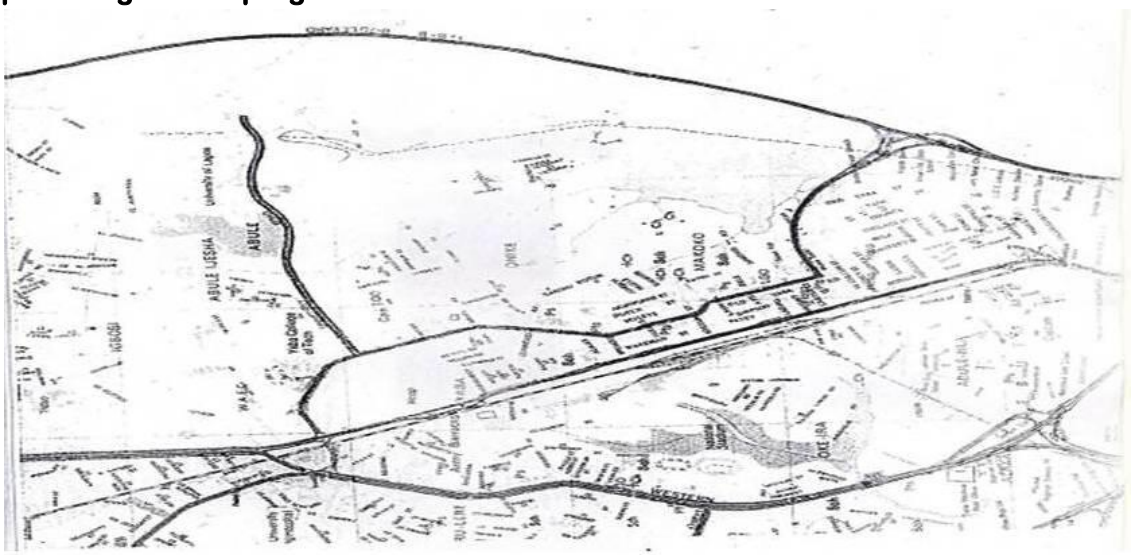
Sampling in air pollution studies, is done with some type of vacuum equipment which sucks the required air sample through a chamber holding a special absorbing solution. The absorbing solution is chemically selected for a particular gas held in a special glass bubbling tube called the impinger. An adjustable flow meter measures the rate of flow of air that is drawn into the absorbing solution; this is usually calibrated in LPM (liters per minute) and is attached to the vacuum portion of the air sampling train.

Establishing a Sampling Sites

Air samples were absorbed about 5m, 50m and 500m from the source of emission and analyzed with their colours compared with the air comparator in order to match with the standard colour.

Sampling Sites:

Map showing the sampling areas.



Source: Lagos State Ministry of Environment, (2003)

Samples were collected from the following sites:

Site A: 5m away from emission point of sawdust burning with presence of thick and heavy smoke.

Site B: 50m away from emission point of sawdust burning, reduced sawdust burning.

Site C: 500m away from point emission. No burning (Blank point).

All sampling were done in the direction of prevailing air, between 11am – 3pm, when activities at the mill was at its peak. Sampling was done at 1.5m above the ground level since personal exposures were mostly within this level. The LaMotte Air Pollution test codes used for SO_2, CO, NOx was 7714, 7782, 7690 respectively. This study was carried out during the rainy

season and each analysis was repeated twice and the mean was obtained.

Result and Discussions

Results of the levels of CO at the three sites are as shown in Table 1, the average CO level at site A was 721 ppm while site B was 29ppm and was not detected in site C (Blank site), these values exceed the recommendation level by FEPA of 20ppm. This is an indication of the pollution justified by the presence of heavy and thick smoke emanating from the burning of the sawdust which is hazardous to the health of inhabitants of the Okobaba sawmills area. Table 2 shows the values recorded for SO_2 pollutant, the mean value at site A was 0.61ppm, site B 0.23ppm and site C 0.08ppm. These values exceeded the approved limits of 0.01 – 0.1ppm by FEPA the high values of SO_2 pollutant in this area is susceptible to acid rain and other associated hazards caused by SO_2 pollution.

Table 1: Levels of Carbon Monoxide

Site	Conc (1) ppm	Conc (11) ppm	Mean ppm
A	720	722	721
B	30	28	29
C	ND	ND	ND

ND – Not Detected

Table 2: Levels of Sulphur (IV) oxide

Site	Conc (1) ppm	Conc (11) ppm	Mean ppm
A	0.6	0.62	0.61
B	0.23	0.24	0.23
C	0.08	0.08	0.08

Table 3 reveals the level of NO_2 pollution, with the mean value at site A being 0.84ppm, site B 0.73ppm and site C 0.04ppm, which far exceeded the recommended range of 0.04 – 0.06ppm by FEPA. This high value of NO_2 pollutant is suspected to be responsible for the acid rain and is evident in the high rate of rusting and corrosion in the roofing sheets of buildings within the Okobaba sawmill area. It is also implicated in skin and respiratory tract irritation.

Table 4 represents values of Federal Ministry of Environment ambient air quality limit standards within certain given number of hours on a daily basis; for each of the selected pollutants.

Table 5 and Chart 1 gives a comparison of the level of CO with the FEPA threshold standards between 30mins and 8 hours intervals. The values obtained from this study show that CO pollution in the Okobaba sawmill industry area were 2000 % higher than the approved value by FEPA after 8 hours of burning the sawdust from the sawmill activities.

Table 6 and Chart 2 similarly compared the level of SO_2 pollution with the FEPA threshold limits, while Table 7 and Chart 3 compared for NO_2 pollution. In all the results obtained, the values far exceeded the approved limits for these gasses.

Table 3: Levels of Nitrogen (IV) oxide

Site	Conc (1) ppm	Conc (11) ppm	Mean ppm
A	0.84	0.85	0.84
B	0.74	0.73	0.73
C	0.04	0.04	0.04

Table 4:FMEnv Ambient air quality limits Standards

Pollutants	Times of average	Limits (ppm)
SO_2	Daily average of 1 hour	0.01-0.1
CO	Daily average hour of 8 hours	20.00
NO_2	Daily average hour of 1 hour	0.04-0.06

Source: Lagos Metropolitan Area Transport Authority (LAMATA)

Table 5: Comparing levels of CO with FEPA Threshold standard

Site	Mean Conc ppm /30mins	Conc ppm/8hrs	FEPA
A	721	2880	20
B	29	116	20
C	ND	ND	ND

Chart 1: Comparing levels of CO with FEPA Threshold standard

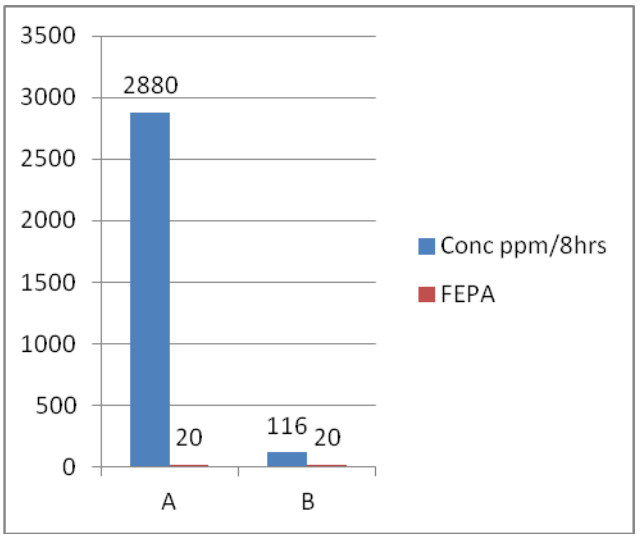


Table 6: Comparing levels of SO_2 with FEPA Threshold standards.

Site	Mean Conc ppm /30mins	Conc ppm/1hrs	FEPA
A	0.61	1.22	0.1
B	0.23	0.46	0.1
C	0.08	0.16	0.1

Chart 2: Comparing levels of SO_2 with FEPA Threshold standards.

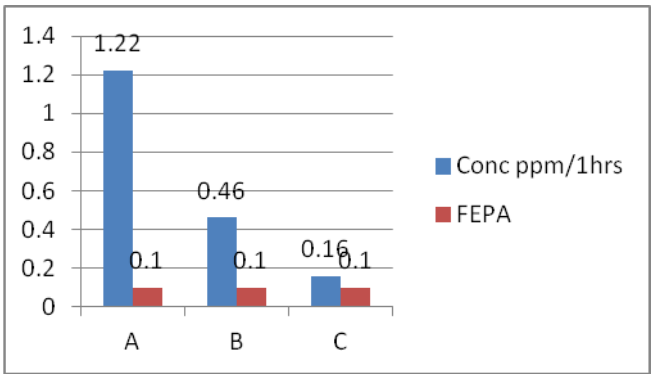


Table 7: Comparing levels of NO_2 with FEPA Threshold standard

Site	Mean Conc ppm/30mins	Conc ppm/1hrs	FEPA/1hr
A	0.84	1.68	0.06
B	0.73	1.46	0.06
C	0.04	0.0.8	0.06

Chart 3: Comparing levels of NO_2 with FEPA Threshold standard

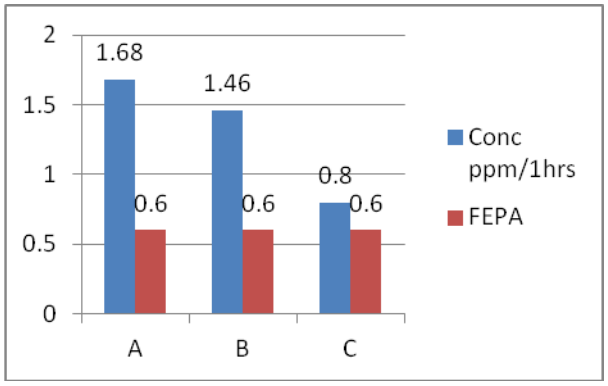


Table 8: Levels of air pollutants in Okobaba sawmill.

Parameters	A	B	C
CO (ppm)	720	30	ND
NO_x(ppm)	0.84	0.73	0.04
SO_2 (ppm)	0.61	0.23	0.08

The result obtained from the LaMotte air Pollution Detection Equipment showed that the activities of the Sawmill Industry has led to the pollution of the environment and has posed health hazards and a risk to the people living and working in the environment.

Conclusion

The result of the analysis of the gaseous pollutants, CO, NOx, and SO_2 which were released into the atmosphere from the massive burning of heaps of sawdust revealed that the environment has been greatly polluted and the fact that the values obtained are much higher than the limits stipulated by the FEPA, implies that the lives of people living and working in this environment are seriously threatened. Moreover, the smoke emanating from the burning of the sawdust causes impairment of respiratory organs, reduction in visibility for both pedestrians and motorists on the Lagos 3rd Mainland Bridge, which could lead to accident. Burning of the sawdust also causes discoloration and weakening of the pillars of the bridge due to acid rain. It is therefore recommended that the burning of the sawdust should be discontinued while alternative disposal method should be enacted. We hereby suggest the usage of the sawdust for land filling, poultry dropping sinks, particle board and wood filling in Furniture Company. All activities that leads to the release air pollutants should be liable to an Environmental Tax Law. Moreover, the Federal Government and all stakeholders as well as other relevant bodies should as a matter of urgency curtail the activities of the sawmill industries to abate the magnitude of environmental pollution in the area.

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