

ANALYSIS FOR LEAD IN ROAD SIDE
SOIL SAMPLES AROUND MINNA

BY

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CERTIFICATION

This dissertation entitled "Analysis for Lead in road-side soil sample around Minna was examined and found to meet the regulations governing the award of the degree of Master of Technology (M.Tech) of Federal University of Technology, Minna and is approved for its contribution to knowledge and literary presentation.

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DECLARATION

I, OMALE, PETER ENEFOLA hereby declare that this work was carried out by me and the literature cited have been acknowledged.

DEDICATION

This work is dedicated to my new-born Family

THE OMALE PETER'S

ACKNOWLEDGEMENT

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CHAPTER ONE

1.1 GENERAL INTRODUCTION

One of the oldest metal known to man is Lead¹. Lead has been used for various purposes in the past, but in modern times it is used mostly in storage batteries, as paint pigments, and in plumbing. Organic lead used as gasoline additive is the current chief source of environmental lead pollution¹. The increased industrial, mining and construction activities and the phenomenal increase in the number of vehicles plying Nigerian roads as a result of the oil boom in the mid-seventies to early eighties has enhanced the potential hazards of environmental lead to man and animals. There is a relationship between traffic volume, and the amount of lead in the air².

Chemistry has achieved great popularity during this decade as a consequence of our increasing concern over the quality of life. However, the gathering of vital data in this field is made cumbersome by the complexity and wide scope of its greatly interrelated aspects on several research areas, all of them deserving serious consideration³. For instance, any National or global policy in this regard affect the previous acquisition of fundamental and applied knowledge on problems such as the world-wide distribution and interaction of chemicals, both of natural and anthropogenic origin, their

modes of transport and ultimate fate as well as the effects on the ecosystem, notably on biological species. In any case, the identification of toxic substances in air, water, food and soil will continue being a constant driving force behind many outstanding research programme and progress along these lines will depend largely on the development and implementation of sensitive and reliable methodologies.

The practice of using tetraethyl lead⁸ and other lead tetra alkyls as additives in petrol was introduced in 1923. They were added to improve the octane rating of low quality petrol for use in high compression engines and to prevent semi-explosive combustion or knocking in the engine. During combustion, the organic lead fuel content passes into the air in the exhaust gases - contributing a nuisance and hence atmospheric pollution.

The main sources of atmospheric pollution may be summarized as follows:

- a. The combustion of fuel to produce energy for heating and power. This is carried out in most industrial/commercial and domestic premises.
- b. The exhaust emission from transport vehicles that use petrol or diesel oil, or kerosene fuel, including road vehicles, diesel locomotives and;
- c. Waste gases, dust and heat from many industrial sites, including chemical manufacturers, iron and steel smelting works, cement and brick works, quarries and electrical power

generating stations.

A considerable amount of air pollution results from burning or combustion of fuels. Fuels are primarily derived from fossilized plant materials and consist mainly of carbon and its compounds. They are burned in air and undergo combustion to produce heat energy, gaseous and solid waste products.

Road vehicles are the second major source of air pollution and a 1973 estimate is given in table below. The data given is based upon nearly 17 million vehicles⁴. About 86% were cars and motorcycles using petrol and 1.06m or 11% were goods and passenger vehicles, which use mainly diesel fuel. Even allowing for the difference in the type of vehicles, it is clear that diesel engines are much less polluting than petrol engines. Both types of engines are not very efficient converters of fuel to energy. However, diesel types with a conversion efficiency of around 30%, must be more efficient and use less fuel than petrol type with a 15 - 20% conversion efficiency. Both types of engine have incomplete combustion of fuel as a characteristic. The proportion of these pollutants varies with the type of engine, its speed, maintenance and operating efficiency.

In the United Kingdom in 1973, it was estimated that over 8,100 tones of lead per year from petrol entered the atmosphere as a toxic pollutant⁴. This figure was probably too low, as a 1977 estimate was 250,000 tones per year. The

primary pollutants produced in vehicle emission undergo a series of complex interrelated chemical reactions in the troposphere and lower stratosphere to form secondary products. A regular daily sampling is carried out at 1200 sites throughout the country (UK) shown on table 1:1 and 1:2.

Table 1:1 Air Pollution from fuels in the U.K (Adapted from clean air year Book 1976)

Pollutant	Output
Carbon Monoxide	16.3
Oxides of Sulphur	6.29
Carbon dioxide	6.2
Smoke	0.84
Grit and dust	0.55
Unburnt hydrocarbon	0.48
Aldehydes	0.26
Oxides of nitrogen	0.26
Lead	0.006
Total	31.186

This result is a more comprehensive estimate of the pollution output in the year 1970 - 71 than the 1973 estimate shown below⁴.

pollution by this element and other members of the group cannot be overemphasized. Certain employers such as policemen, garage workers have accumulated relatively high body lead concentration. Similarly residents living near motor ways and interchanges are also at risk where there is a sustained high concentration of vehicle exhaust fumes.

Soil normally contains small amount of heavy metals like Pb, Cd, Hg, Cu, and Zn. Those used in fuel and lubricants find their way into the atmosphere and drift across near heavily travelled routes. The soil beneath some fruit trees becomes heavily contaminated with heavy metals that dropped or washed from the trees. The washing away of soil contaminated with lead into a water supply may arise from industrial mine and smelter discharge or from dissolution of old plumbings; all of these contribute to environmental pollution.

Concentrations of lead, Cadmium and mercury in surface layers of forest soils in southern Sweden are now between three and ten times higher than they were before the industrial revolution.

"It's difficult to come any firm conclusion about what effects this accumulation of metals in the soil may be having on ecosystems today", say Birgita Timno at the Sweden Environmental Protection Agency (SNV). She has been involved in drawing up assessment criteria for metal pollution of forest and farm soils.

In report, SNV calculates that atmospheric deposition of

metals in Sweden must be reduced by over 50 per cent in the case of Lead, 80 per cent in the case of mercury and 50 per cent in the case of Cadmium, if further increases in soil concentrations are to be avoided. This would safe guard the long-term productivity of soils and ensure that metal pollution does not jeopardize the structure and functioning of ecosystems. This would also make sure that food obtained from soil and water does not pose a health risk to people or animals.

Lead is the ultimate product of the various radioactive decay series. Radiation carcinogenesis in man, genetic effects, experimental radiation carcinogenesis and developed effects of irradiation in utero have been recently reviewed by UNSCEAR ⁷. The most important somatic effects are malignant diseases and disturbance in pre-natal development.

In human beings small dose produce behavioural changes. This element under investigation with a half-life of 22 years is particularly hazardous because it is excreted slowly. Most accumulated lead is stored in the bone, however accumulation in the nervous system causes swelling of brains tissues. It also disrupts the normal production of red blood cells causing anaemia. Pregnant women are especially vulnerable and there is evidence that young children can be harmed⁸. Recurring lead poison may be followed by permanent injury to the kidney. This problem can be arrested by administering chemical substances that allow lead to be excreted more easily from the body.

1.2 MECHANISM OF HEAVY METAL INORGANIC TOXICITIES.

Although heavy metals were formerly important therapeutic agents, interest now lies with the toxic reactions they are capable of producing. The problem created by water and air pollution, food contamination and the widespread use of agricultural chemicals are largely concerned with these toxicants. Humans, as well as domestic and wild animals are vulnerable.

In order to recognize study, and treat the conditions caused by these compounds, the biological distribution and fate of heavy metals must be understood. It is generally recognized that the absorption of inorganic compounds depends largely on their solubilities.

1.3 ABSORPTION OF LEAD

Metallic lead is slowly but constantly absorbed by most routes except the skin. Skin abrasion and lesions, however will allow significant absorption. Lead particles absorbed in sufficient concentration can cause poisoning within one month. Respiratory tract absorption of lead dust is commonly the cause of industrial poisoning. Lead is absorbed from all portions of the respiratory tract including the nasal passages, and indeed the absorption is more complete and rapid than by any other route⁸.

Lead is rapidly removed from the plasmato combine with blood cellular elements. Nearly all of the circulating

inorganic lead is associated with the erythrocytes, chiefly in the membrane stroma⁹.

The tissue concentration in the kidney provides higher levels for a longer period of time than do any other tissues in the body. Kidney thus provides the best tissue for analysis¹⁰. Lead concentrations in hair gradually increase until two months after the last lead administration. The degree of exposure to lead maybe fairly evaluated by measuring the hairs lead content¹¹. Despite the frequency of lead poisoning, little work has been done on the metallic action and biotransformation of inorganic lead. Although generally assumed to be a protoplasmic poison and to combine with sulphhydryl groups (resulting in enzyme inhibition), the relative ineffectiveness of dimercaprol treatment and the affinity of lead for bone suggest that dithiol binding is the only mechanism involved in vivo and that other interaction should also be investigated. Complete inhibition of the sulphhydryl - containing enzyme succinoxidase has been demonstrated in the dog ⁽¹²⁾. Other studies have shown that Lead produces an inhibition of active potassium transport in the red blood cell membrane, a finding consistent with the occurrence of anaemia and increased cases^(9,13). Porphyrinuria is one of the first signs of lead poisoning.

Inorganic lead is excreted from the body chiefly in faeces and urine, the concentration being dependent upon the duration of exposure to the metal. In an earlier study on the

use of urinary-d-aminolevulinic acid (ALA) excretion in humans and cattle as an index of exposure to lead in the Zaria environ⁽¹⁴⁾, it was concluded that persons exposed to lead-contaminated environments, like automobile lead battery charger and leaded gasoline attendants, had elevated urine ALA concentrations while rural humans and cattle did not have significant urinary ALA elevations.

90% of orally ingested lead is unabsorbed and passed in the faeces. In addition, the small quantities of lead excreted in the bile and from the intestinal mucosa are present⁽¹⁵⁾. Most of the absorbed lead is excreted by the kidneys at rates directly proportional to the rate of absorption. Industrial workers in Lead smelter plants have excretion values of 5-736ug per 100ml of urine⁽¹⁶⁾. The urinary excretion of lead in sheep is dependent upon the quantity of lead absorbed, but does not exceed 0.8mg/day⁽¹⁷⁾. The Concentration in the tissues diminish in accordance with urinary excretion and reach normal levels in 12-18 months. The skeleton is the last tissue to return to normal^(9,18).

Lead is eliminated through the milk in proportion to the concentration found in the blood cells, but probably never exceeds 1.0ppm. The concentration of lead in the sweat is about the same as that in urine, but the total quantity excreted is small⁽⁹⁾. The excretion is enhanced by conditions that favour mobilisation of bone and soft reserves. Dietary imbalances, vitamins D deficiency, parathyroid hormone, acidosis

and iodide and biocarbonate administration increase urinary level of lead. Exogenous chellating agents such as calcium disodiumedetate, penicillamine and dimercaprol also serve to dislocate lead from bone deposits and to hasten its urinary excretion.

Metals have characteristic affinities for certain organs systems. The consequence of preferential localization in certain organs of the body are not necessarily bad. As an example, lead has a high affinity for the bone. More than 90% of the lead in the body is localized in bone, yet the toxic effects of lead are the result of its presence in much lower concentrations elsewhere in the body notably in the hematopoietic and in the central nervous system respectively.

It has been stated that acidosis (by NH_4Cl) enhances the excretion from the bone⁽⁹⁾. It is conceivable that under some circumstances acidosis could convert a latent toxic burden to an active one. Translocation of metals from one point in the body to another has been shown to result from the administration of chellating agent. In the case of lead, administration of chellating agent EDTA (ethyl diamine tetracetate) causes translocation of lead from bone into muscle⁽¹⁹⁾. The effect is transient and of doubtful toxicologic significance.

In view of the above and increased government efforts to protect the environment, it has become very necessary to study the extent of lead contamination on Minna roads. This study

intends to analyse the amount of lead in road side soil samples as a measure of dispersion of lead on Minna roads.

This project will contribute to this effort by studying:

1. Soil samples along heavily travelled routes in Minna.
2. make a comparative study of lead content of road in the dry and rainy season, and
3. this is compared with a typical She village with very low traffic along Kuta road in Minna.

CHAPTER 2

2.1 INSTRUMENTATION

2.2 Introduction.

The Atomic Absorption Spectrophotometer (AAS) has been chosen for this study because it is less prone to inter element interference effects. In this system, radiation sources are specific for each element to be measured⁽²⁰⁾. This overcomes the problem of overlap of spectral bands that frequently occurs in flame Photometry. Partly for this reason and partly because of inter-element effects Atomic absorption Spectrophotometry (AAS) is generally preferred⁽²¹⁾.

In order to observe the optical properties of free atoms, the sample must be in the gaseous state, and this generally requires volatilization of liquids or solids followed by the dissociation of molecules to give free atoms.

2.3 Atomization

There are a number of techniques²² by which metallic elements can be atomized, in most cases by heat energy, either electrically produced or from a flame. Careful control of the temperature is needed for optimum conversion to the atomic vapour. Too high a temperature can be just unfavourable as too low, as it will cause a fraction of the atoms to become

ionised and hence not to absorb at the expected wavelength. On the other hand, a high temperature tends to reduce matrix effects, and so is desirable.

The fuel and oxidant gases are fed into a mixing chamber, where they proceed through a series of baffles to ensure complete mixing, to the burner head.

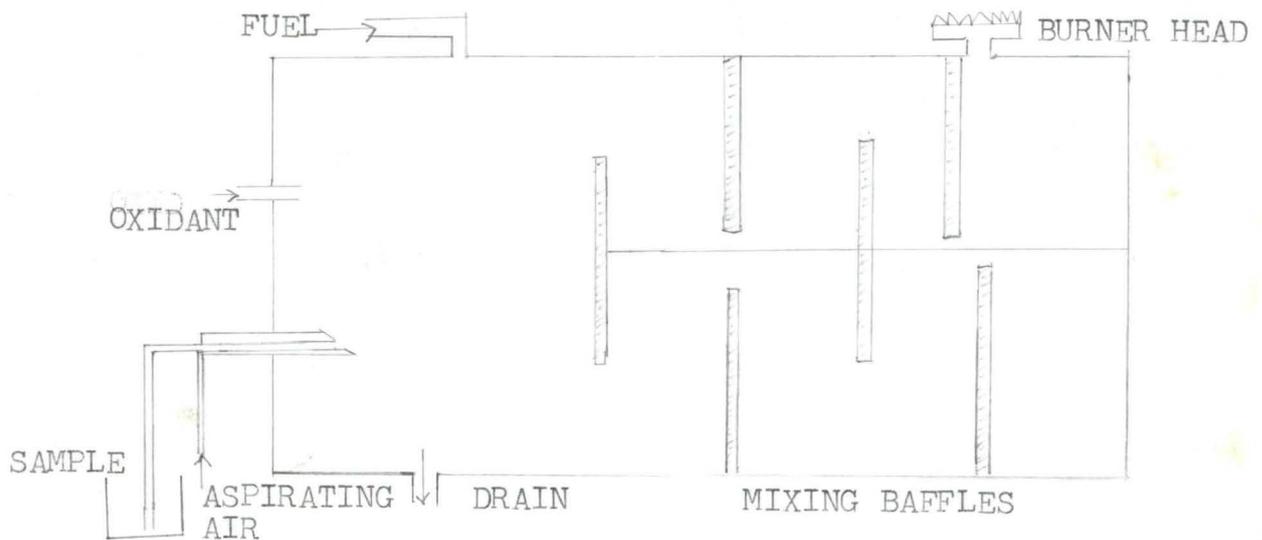


Fig.2.1 Laminar Flow; premix for Atomic Absorption

The flame orifice is in the form of a long, narrow slot, so that a ribbon flame is produced. The sample, in solution, is aspirated into the mixing chamber by a small air jet. This kind of aspiration produces droplets of a wide range of sizes; which would lead to poor reproducibility. This is overcome by contact with the mixing baffles which tend to intercept the larger drops, so that those reaching the flame are smaller and more nearly uniform.

A burner using premixed gases presents a safety hazard if

the flame should strike back into the mixing chamber, a violet explosion would ensue. The likelihood of a flashback is minimized by making the burner slot as narrow as possible so that the gases will blow through at a high velocity and by making the metal parts around the slot rather massive so that heat will be conducted away readily. Even then, explosion can occur if the gas flow is not adjusted properly.

Compressed air and acetylene are most commonly chosen as oxidant and fuel for Atomic absorption. the maximum temperature attainable is about 2200°C. When higher temperature is needed, nitrous oxide (N_2O) can be substituted for the air. This gas decomposes to give a 2:1 mixture of nitrogen and oxygen, compared to the 4:1 ratio in air; the highest oxygen cannot be used with acetylene in a premix burner because the flame propagates so rapidly that flashback cannot be avoided.

Although the flame is a convenient and reproducible source of heat, it is less than ideal as a sampling device for Atomic absorption, in that the two sequential endothermic processes (solvent evaporation followed by atomization), must take place within the very short time interval that it takes for a particle to shoot through the flame. In addition, the flame introduces significant random fluctuation in the effective optical path length, because of turbulence, this causes excessive noise in the signal.

2.4 Sources of Radiation

Atomic Absorption Spectrophotometers use special lamps that generate line spectral characteristic of specific elements. These are much more effective when used with medium resolution monochromators which function to select the emission line desired.

The most successful line source for Atomic absorption is the hollow cathode lamp. This consists of a glass or quartz envelope containing two electrodes, one of which (the cathode) is cup shaped and made of the specified element. The material of which the anode is made is not critical. The lamp is filled with a noble gas at a low pressure. Application of 100 to 220V will produce, after a short warm-up period a glow discharge with most of the emission coming from within the hollow cathode. Positive ions from the inert gas bombard the cathode removing metal atoms by a process known as sputtering.

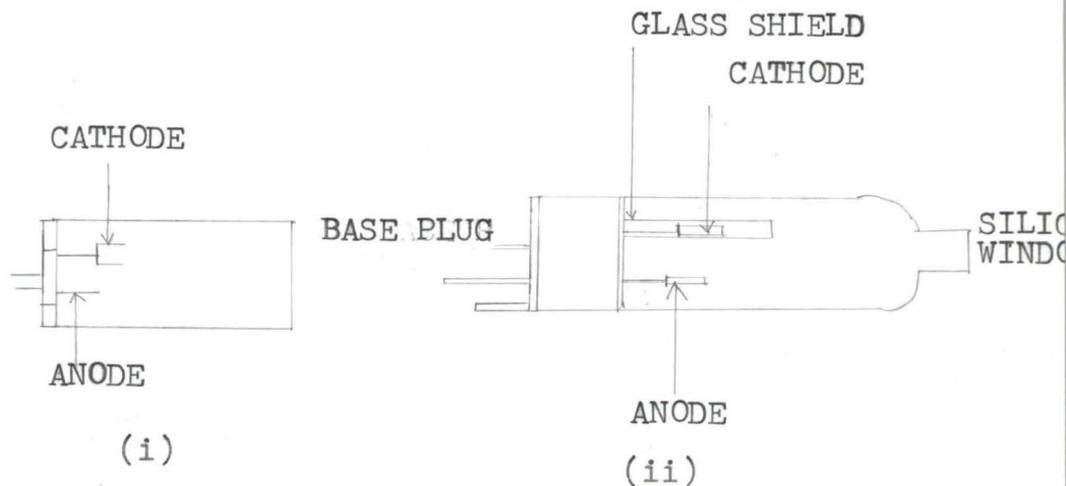


Fig. 2.2 Schematic diagram of a lamp.

These atoms can accept energy of excitation and emit their characteristic radiation. The emission consists of discrete lines of metal plus those of the noble gas, the gas is selected by the manufacturer to give the least spectral interference with the metal concerned. Diminution in power of the beam of radiation reaching the detector is directly dependent on the number of the atoms of the metals encountered in the sampling area.

2.5 Other Lamps.

It is possible to fabricate hollow cathode lamps which are also available with mixture of several metals lining the cathode cup, as long as they do not interfere spectrally with each other, and provided that they require about the same amount of energy for atomization. This makes it possible to determine several elements without the necessity of changing lamps.

Hollow-cathode lamps take after turn-on to reach a steady output. This is particularly annoying with single lamps if several elements are to be determined on the same sample. One way to overcome this difficulty is to provide a turret assembly that will hold several lamps, maintaining them at standby, so that any one of them can be rotated into position for use. A double beam system to correct for varying lamp brilliance will also serve to shorten the delay when changing lamps.

Another type of lamp that can be used as a source in

Atomic absorption is the electrodeless discharge lamp. This consist of a sealed quartz tube containing a small amount of the pure metal and a low pressure of an inert gas. It is excited by an intense microwave field in a wavelength cavity, and emits essentially the same spectrum as its hollow-cathode counterpart.

2.6 Background Correction

In Atomic Absorption Spectrophometry, background correction is essential for quantitative work. The background signal arises in part from the radiation emitted by the hot sample itself. The source of background is unique to Atomic absorption, resulting from the inevitable electronic excitation of analyte atoms that spontaneously emit photons at the same wavelength being studied in absorption.

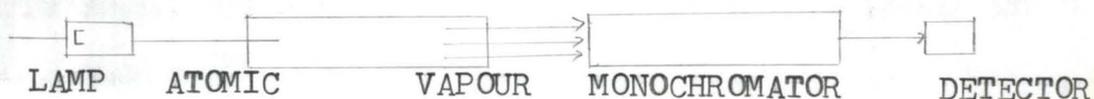


Fig. 2.3

(a) Continuous operation without chopping. Emission from hot sample adds to the radiation from the hollow-cathode lamp leading to ambiguity.

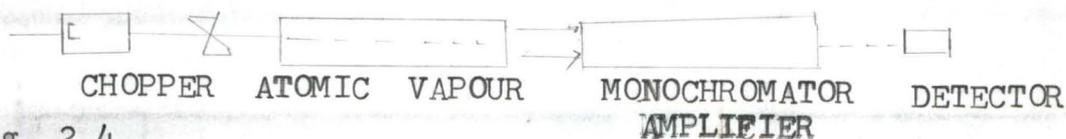


Fig. 2.4

(b) with chopping, only the radiation from the lamp is observed by the detector with its selective electronics.

If no precautions are taken, the observed radiant power, P_{obs} , will be given by $P_o T + P_e$, where P_o is incident power, T is the transmittance of the sample and P_e is that portion of power emitted by the sample that reaches the monochromator. since the radiation relation to P_o and P_e are the same wavelength, both pass through the monochromator to the detector, and are indistinguishable from each other. This effect can be eliminated by chopping the radiation from the hollow cathode lamp as shown in (b); leaving untouched the radiation by particles of smoke from the sample matrix, and, with flame excitation by turbulence.

The background may also contain contribution due to absorption by other components of the sample. Several methods have been described for minimizing this type of interference.

i. The use of continuous source, such as H_2 or D_2 lamp, simultaneously with the line source^(7,8)

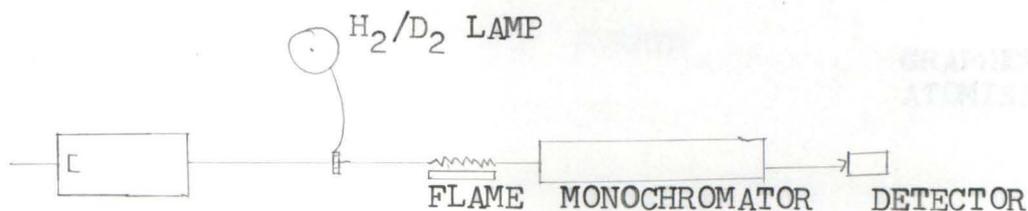


Fig. 2.5

Radiation from the auxiliary lamp passes through the sample along with the resonance radiation from the hollow-cathode lamp.

turned so that the plane of polarization of the beam is either parallel to or perpendicular to the orientation of the magnetic field. When the radiation is polarized at right angles to the field, it is not absorbed by the atomic vapour, but when parallel, absorption takes place as it would if the field were not present. However, the absorption due to the background is no different in the two situations, and so subtraction of one (perpendicular) from the other (parallel) gives an absorption spectrum free from background. This has the advantage over the D_2 lamp method that, since only one lamp is used, and no special alignment problem exists. Other alternative arrangements of the components in a Zeeman-corrected spectrophotometer are possible^(23,24). Their relative merits have been discussed in a recent review⁽²⁵⁾.

iii. The third method of background correction is based on the technique of wavelength modulation⁽²⁶⁾. Yet another method for background correction has recently been announced⁽²⁷⁾, that has much to recommend it. In this method, the hollow-cathode lamp serves as its own corrector. A low current pulse (12mA) is applied to the lamp to measure the absorbance of the desired element plus background. Then a brief high current pulse (250mA) is applied to broaden the emission line from the lamp. The relative absorption by the sample element is greatly reduced, whereas the background absorbs a constant proportion of the radiation. The difference between the two signals gives the corrected analytical information.

2.7 Detection Limits.

The sensitivities of Atomic absorption methods depend in a complicated way on the:

- i. optical properties of the atomic vapour
- ii the temperature
- iii the relative line width of lamp and absorber
- iv and the geometry of the optical system.

2.8 Interferences

The chemical reaction taking place in a flame can give rise to interferences in Atomic absorption Spectrophometer. The chief difficulty is due to incomplete dissociation or to the formation of refractory compounds.

Interference could arise from differences in viscosity or other bulk property of the solution, altering the ease with which it is aspirated and transported through the flame. thus two solutions with the same concentration of metal but varying amounts of other extraneous materials may give different instrument readings.

The 283.3 nM wavelength is often preferred for routine determinations ²⁸ because of the better signal to noise ration and lower background interference effects have been reported for the determination of lead.

CHAPTER 3

3.0 EXPERIMENTAL TECHNIQUES

3.1 Sampling Techniques and Strategies.

During the initiation of any project in which the conceptual model of the site indicates that soil is one of the key factors, proper planning and selection of the technique and strategies for collecting the sample is essential⁽²⁹⁾. Several general characteristics of the site and/or problems that affect a soil sampling project at the preliminary must be considered. These characteristics include:

- (i) the type and distribution of the contaminant (or other constituent of interest).
- (ii) the natural soil characteristic that can influence the distribution of the contaminant of concern, and
- (iii) the nature of the media to be sampled (i.e. soil vs non-soil materials, or a combination of the two distinctly different media).

One of the basic characteristics of the site and problem have been clearly identified, the strategy and techniques for collecting the soil sampling protocols, the investigator should consider the following issues:

- i the size or area of contamination;
- ii particulate sampling theory or address proper sample and

sub-sample collection;

- iii statistical aspects pertaining to soil sampling;
- iv the use of relevant historical data;
- v sampling designs and their appropriate use;
- vi proper sample collection procedures;
- vii other types of sampling of soil materials and;
- viii interpretation of the final results.

When each of these issues is properly considered and addressed, a solid basis for the development of a soil sampling protocol will have been established.

The minimum amount of soil required is based upon the relationship between variability of the material, particle sizes in the material, distribution of the contaminant of interest and size of the sample taken⁽²⁹⁾. The variability found in particulate material such as soil, is based upon the number of individual particles in the sample. therefore the controlling factor in the collection of the correct sample is the size of largest particle.

Sample handling techniques that are often used to reduce sample variability (or sample error) includes:

- 1 sub-sampling and sample size reduction;
- 2 composite sampling; and
- 3 sample homogenization.

When a sample of any population, such as soil is collected, it is usually necessary to reduce its original size to smaller quantity of material for chemical analysis (i.e a

sub-sample). the guiding principle for the sub-sample selection is that the probability of collection of all fraction of the soil must be equal.

3.2 Sample Collection Procedure.

There are two (2) portions of the soil that are important to the environmental investigator⁽²⁹⁾. The simple layer (0-15cm) reflects the deposition of airborne pollutants, especially recently deposited pollutants, and pollutants that are strongly bonded to soil particle. On the other hand, pollutants that have been deposited by liquid-spills, by long-term deposition of water soluble materials, or by burial may be found at considerable depth.

The sampling methods, therefore varies; however, two most frequently used techniques are:

- i core sampler or auger device
- ii excavations or trenches.

Samples, (soil/dust) were taken at approximately 1.0m intervals at various points along the following routes - Minna-Suleja, Minna-Bida, Minna-Zungeru, Minna-Kuta roads and locations in She village. Samples were also taken from isolated bush land along airport road, Maikunkele, Mobil Junction, Kpakungu and central motor parks.

3.3 EXPERIMENTAL PROCEDURE

3.3.1 Reagents Used.

The reagents used in the current studies were all of analytical grade, hence further purification was not necessary. These include;

- i concentrated trioxonitrate(v) acid;
- ii concentrated Hydrochloric acid;
- iii Distilled and deionised water.

3.3.2 Sample Preparation

Soil samples were oven dried at about 120°C for one hour. for each sample, a sub-sample weighing 1g was taken in a 250cm³ beaker. 60cm³ of acid mixture of PH = 2.21 (This was prepared by taking 252cm³ of Concentrated Trioxonitrate (v) acid and 60cm³ of Concentrated Hydrochloric acid in one litre volumetric flask, the mark was made up using deionised water) was accurately measured and poured into the sub-sample in the 250cm³ beaker. This was digested on a steam bath for two hours.

The blank was prepared by washing the filter paper with 60cm³ of the acid solution and made up to mark in a 100cm³ flask using deionised water.

After digestion, the solution was allowed to cool and later filtered using whatman filter paper and washed with deionised water. The filtrate and washings were poured into a 100cm³ graduated flask and made up to the mark.

3.3.3 Calibration Graph

A calibration graph for lead was prepared. This was done by dissolving 1.5980g of lead trioxonitrate (v) salt in 100cm³ of deionised water. This was diluted to one litre in a volumetric flask using deionised water and stored in a polythene bottle.

Standard solution containing between 0-15 ppm were prepared. these were done by taking appropriate volumes of stock solution in 100cm³ volumetric flask and the mark made up using deionised water.

The standard solutions were then aspirated into the spectrophometer with the wavelength set at 283.3nm. The aspiration was done in descending order i.e. starting from the highest concentrated solution to the lowest. between each aspiration, deionised water is aspirated into the system for few minutes. This was to clear the flame of the previous solution.

A calibration graph was drawn (fig3.1) and this was used to find the concentration lead in the samples.

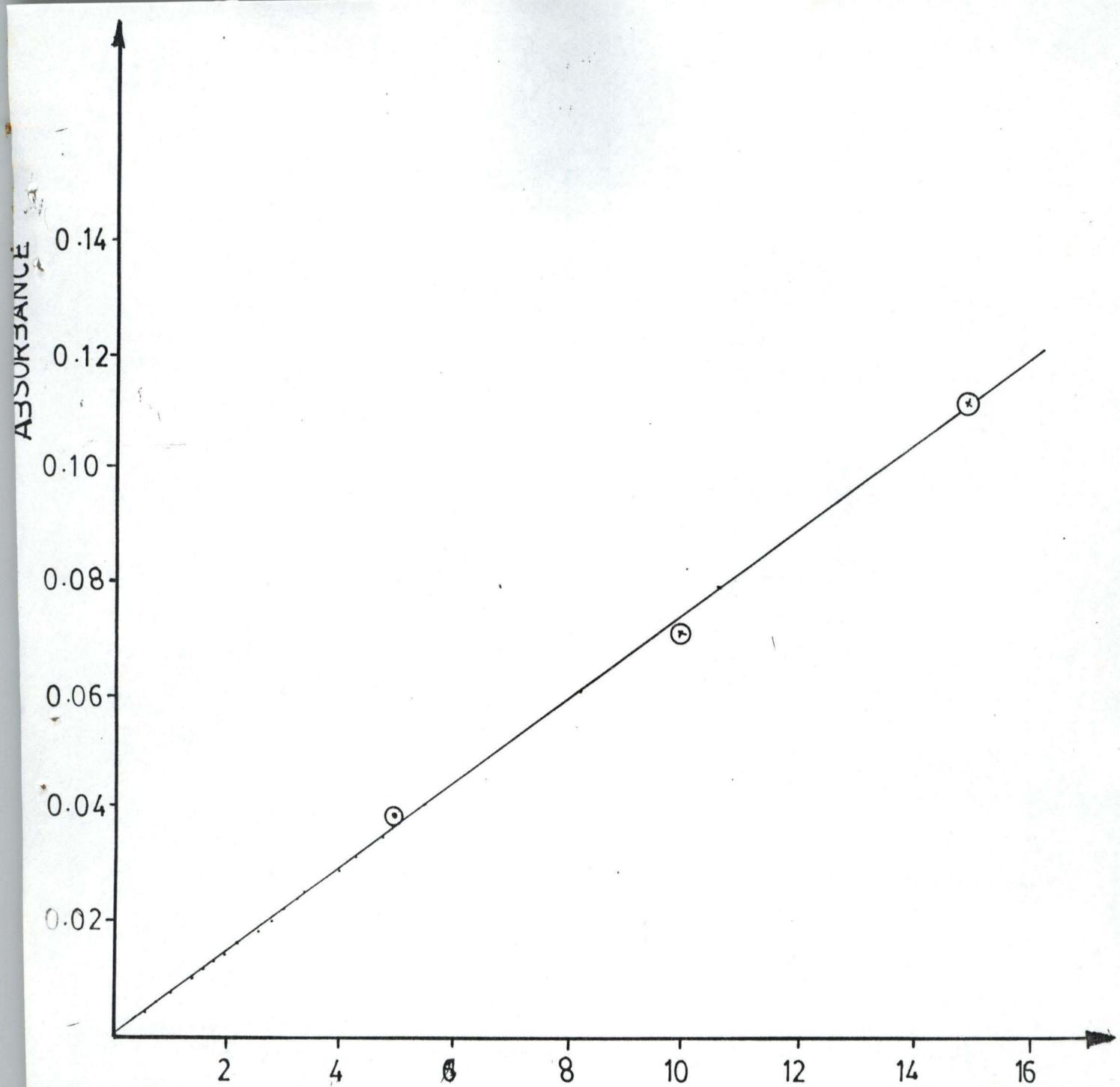


Fig. 3.1: DETERMINATION OF LEAD (CALIBRATION)

CONC. (PPM)

CHAPTER 4

RESULTS AND DISCUSSION

Analysis for lead in road-side soil samples as a measure of probable environmental contamination using the Atomic Absorption Spectrophotometer technique is preferred to other methods that are available (e.g calorimetric method). In the current studies, the technique employed i.e. the Atomic Absorption Spectrophotometry (AAS) method with or without solvent extraction for lead is most preferred at present.

Tables 4:1 and 4:2 show lead contents of samples taken from the most preferred travelled routes in Minna environs and the village during the rainy and dry seasons as can be seen from the bar chart (fig 4.1). The highest lead content was found in the dry season (10.60ppm) compared to the rainy season (2.20ppm).

Significant differences were observed in the amount of lead between the travelled routes, the parks and locations in the village.

The heavily travelled routes - the Suleja-Minna, Minna-Bida, Minna-Zungeru, Minna-Kuta routes have recorded appreciable level of lead. This could be attributed to the increase in transport activities involving simple and heavy automobiles capable of emitting this heavy metal.

Soil/dust samples were also taken from the central Minna

and Kpakungu parks for comparative reason. the amount of lead in these areas are appreciably higher. The parks are prone to lead pollution as these vehicles are left on for a long time before take-off and parking respectively.

In she village, the traffic flow is generally very low. Few vehicles were seen along the sampling sites. The average amount of lead found compared to that obtained from Minna sites was very low.

The variation in the results i.e. between the dry and rainy season could be attributed to the washing away of the top soil by rain water. The presence of oxides of Sulphur, Nitrogen, and Carbon in the atmosphere from pollution activities may shift the PH of the rain water toward acidic condition which may help to elute the lead from the soil surface.

It is probable that the reported lead concentration in the dry season could be higher but for wind erosion which may carry the emitted lead away in the direction of the wind and may not be deposited in the area of interest.

Other parameters for discussion include the soil vegetation along this routes on the emitted metal could be deposited on the immediate vegetation. This would be developed in future work.

The gasoline refining Companies have now put so many researches in place to analyse on a continuous basis the reduction in the amount of lead additives to avoid environmental pollution.

4.1 Results of Analysis for Lead on Minna roads.

S/No	Location	Rainy Season ppm	Dry Season ppm
1.	Tunga (Top Med. Bus Stop)	0.60	2.80
2.	Tunga (2)	0.80	2.60
3.	Mobil Junction	1.60	4.80
4.	NITECO road	0.65	1.80
5.	Bosso (FUT Bus Stop) 1	1.40	2.20
6.	Bosso (under bridge) 2	1.60	3.40
7.	Myapa Junction (1)	0.80	2.60
8.	Myapa road (2)	1.40	2.20
9.	Bosso Estate road	1.00	3.00
10.	Tundu Fulani	1.60	3.20
11.	Maikunkele road	1.40	2.60
12.	Kuta road (New market)	1.00	2.20
13.	Minna park	2.20	8.20
14.	Bida road (Kpakungu)	2.00	4.00
15.	Kpakungu park	2.20	10.60
16.	CHE Lab lounge	0.65	1.00
17.	Staff Quarters road	0.60	0.80
18.	Bush land (Airport road)	0.40	0.65

4.2. Result of analysis for Lead on She sites.

S/No	Sampling Sites	Rainy season ppm	Dry Season ppm
1.	Grinding Engine Site	0.65	1.00
2.	Main Bus Stop	1.00	1.40
3.	SHE road (i)	1.40	0.80
4.	SHE road (ii)	0.60	0.80
5.	SHE road (iii)	0.65	0.95
6.	SHE road (iv)	1.20	1.40
7.	SHE Local Park	1.40	1.60

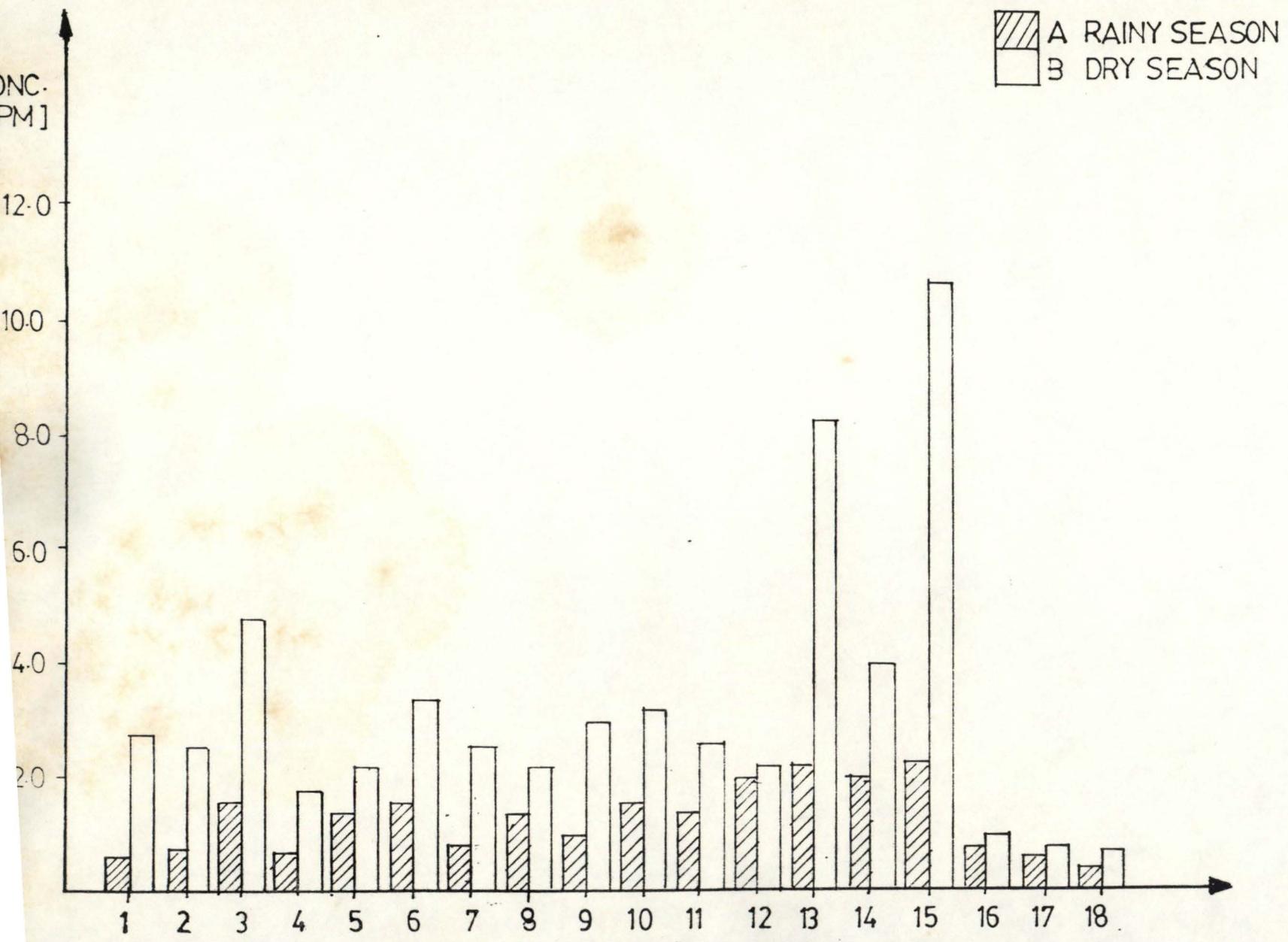


Fig. 4.1 DISTRIBUTION OF LEAD IN TWO SEASONS (A & B) SAMPLING SITES

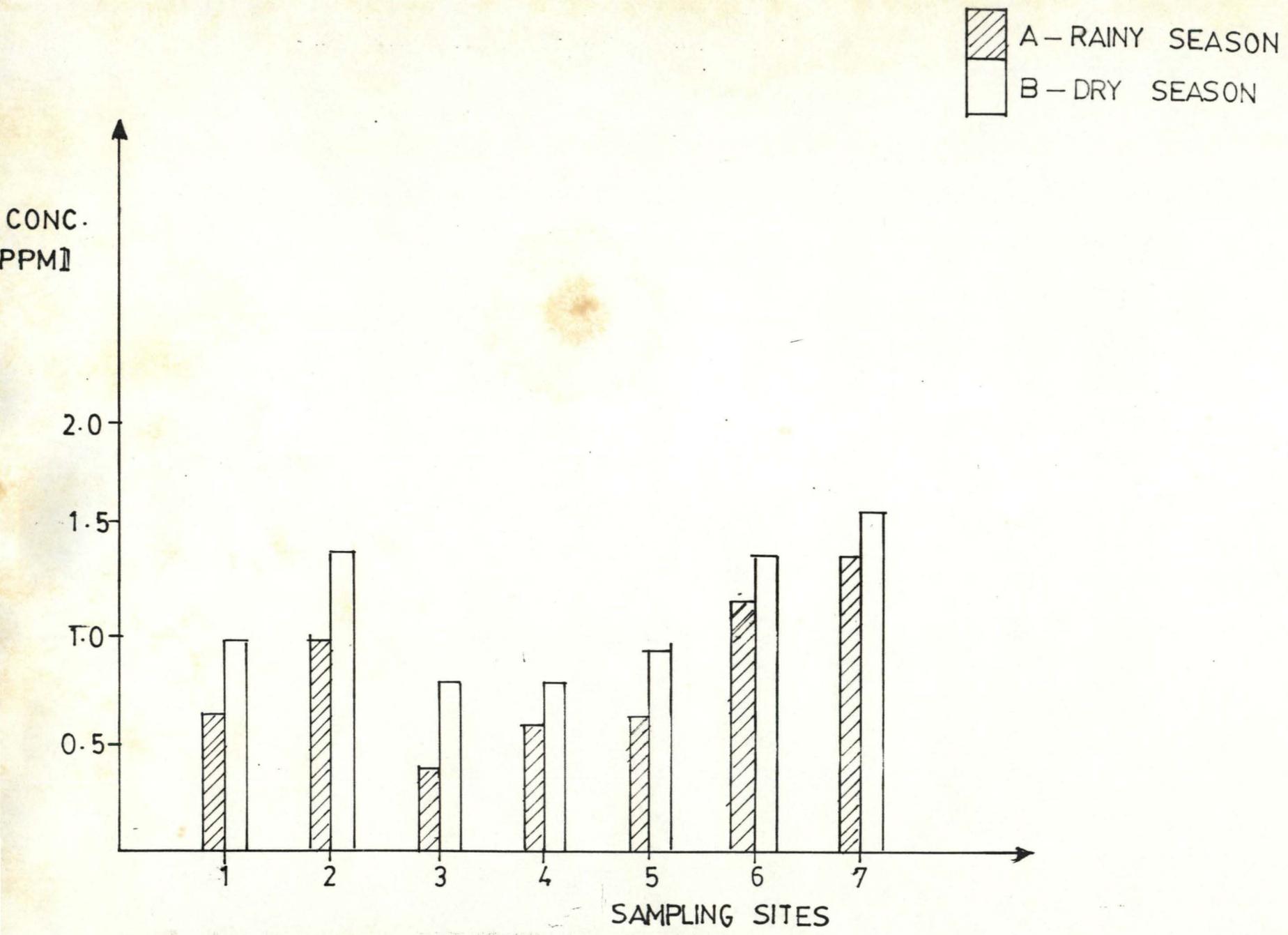


Fig. 4.2 DISTRIBUTION OF LEAD IN SHE VILLAGE

CHAPTER 5

CONCLUSION

The determination of Lead using the AAS machine is reliable for its high sensitivity and convenience. the extent of environmental Lead contamination cannot be decided until a research of this nature is supported to constantly monitor the seasonal variations over a period of time.

However, there is need for more zonal and regional studies in order to ascertain the exact extent of contamination in Minna and in Nigeria in general; especially in areas with high automobile density.

The results reported here are based on small scale laboratory work. It may be different if monitored for a period of time.

It could be suggested that:

- i. a study on the design of a transport system that would be environmentally sustainable in the long term be embarked upon.
- ii. the use of leaded petrol should be discouraged
- iii a new classification and standard scheme for motor fuel be evolved.

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