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Assesment of pesticide residues in water and sedimet in Njuwa Lake, Yola Adamawa State, Nigeria

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Abstract: *Pesticides residues in both water and sediment could be a health risk in the fishes consume from Njuwa Lake Yola, Adamawa State Nigerial. The Levels of pesticides residues in water and sediments in lake Njuwa Yola wasinvestigated. The analytical methods usedinvolved solvent extraction of the pesticides residues by soxhlet extraction, cleaning and their subsequent quantification using hyphenation of gas chromatography mass spectromatry (GC-MS). In this technique, mass spectrometer acts as a detector for the compounds separated by a gas chromatography. Result of the Mean concentrations (µg/l) of pesticides residues in water ranged from (0.15 – 0.92). The mean concentrations (µg/g) of pesticides residues in sediment at south, north,west, and eastern sites of the Lake were ranged from (0.91 – 1.21), (0.92 – 1.07), (0.73 – 1.21) and (0.82 – 1.03), respectively. The pesticide residues found in the present study are generally above the maximum residues limit (MRL) set by FAO/WHO bodies. This indicate that the pesticides residues could pose a health risk to the consumers of the fishs from lake Njuwa.*

Keywords:*pesticides,Herbicides, Insectides,Gas Chromatography, Mass Spectrometry.*

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I. Introduction

During the past five decades, the use of agrochemicals including pesticides has contributed to a sgnificant increase in major crop production [1]. Pesticides are used in agriculture for three main purposes, to produce a larger yield of crop, to produce a crop of better quality and to reduce the input of labour and energy into crop production. Even now, approximately 25% of the potential production of the world's crop is destroyed by pest, weeds and diseases, either by direct attack upon the growing crop or damage and destruction to the stored harvest [2]. In practice, the appropriate use of pesticides has been responsible for increase in the productivity of agriculture, both in terms of output per unit area and output per man employed. In Nigeria, less and less number of persons are engaged in agriculture, in terms of total population of the country, every passing year, but there is regular increase of food production [3]. This increase in efficiency is clearly not solely related to the pesticides, the progressive mechanization of farm operations and the development of high-yielding crop varieties being other important factors. However, pesticides use has undoubtedly played a part in the maintenance of this trend.The use of increased quantities of fertilizsers and pesticides, which has done so much to improve agricultural production in recent years, also involves a considerable energy input in relation to the extraction and synthesis of chemicals[4].

The extent to which different types of pesticides are used to control agricultural pests is now increasing everyday several kinds of insecticides such as DDT are used in large quantity to control diseases like malaria and filarial [2,3]. These chemicals are poisonous and are washed into rivers and lakes endangering fish life. The pesticides and insecticides used are DDT, eldrine, dieldrine benzene hexachloride., endosulphan, endrex, folidol, demeton, and phosphamidon [6]. Chemical fertilizers are used in agricultural fields like urea and superphosphates are washed down into fishery ponds and nursery tanks, this are prove to be harmful to all sorts of organism [5]. Studies indicates that organochlorine pesticides (OC_5) are far more toxic than organophosphorus compounds (OP_5) [6,7,8,10]. It has also been shown by laboratory experiments [9] that a mixture containing pesticides belonging to different groups (OP_5 and OP_9) is far more toxic to fishes than when they are alone. This is called joint toxicity[1,3].

Application of pesticides to aquatic environemt inevitable result in some of the pesticides being diluted and dispersed, without necessarily reaching the target organism, at least in effective concentrations.

Pesticides may accidentally enter water and in some cases the soil and sediment by spillage, misuse, cleansing or disposal of containers and from industrial and domestic effluents.However such factors may

contribute little to the overall level of environmental contamination by pesticides. They may be very important at times in localised situations especially when the added concentration is substantially high.

Many different factors regulate the mobility and toxicity of pesticides in the environment. Pesticides mobility in sediment or water is reduced by absorption of the chemical to biotic and abiotic surfaces [10]. Although in such cases an equilibrium between adsorbed and disorbed states is likely attained. Furthermore, applications to control animal pest or incidental uptake by non target animal may result in accumulation, metabolism and excretion or transfer to higher trophic levels in food chains with possible further accumulation. In addition, Pesticides come under a varity of influences by their own molecular characteristics, which determine their fate[11]. Thus, chemical structure, and consequently biological activity may be altered by physical, chemical and biological agencies.

This study is aimed at determinig the concentration of pesticide residues in water and sediments of Lake Njuwa to advice fish consumers on the toxicity level of the aquatic environment.

II. Materials And Methods

Study Area

Lake Njuwa is locate at near Rugange, Yola, Adamawa State it lies on latitude 09º 18' 11" N and longitude 12º 25' 26" E. Lake Njuwa occupies natural depression near the upper River Benue in the north east Nigerian. The lake Njuwa is flooded by the river during the raining season such that it receive influx of water which pollution load originated from river Benue upstream lekdo dam from Cameroon Republic. The water from the lake is primarily used for fishing and a source of water large cattle farmer in the areas. Show in figure 1. The surrounding farmlands rely entirely on the lake for irrigation faming during dry season. According to the information from the Rugange village head and head of the local fishermen, the lake formed naturally from river Benue that was cut off as a result of heavy siltation about 100 years ago, thereby forming a lake. It is a shallow water body of about 250 hectares in size with mean depth of about 3 meters. Aquatic vegetation on the lake consists of mass of floating weeds such as Typha sp an aquatic emergent plant, Pistia sp is a water floating plant and Salvinia sp a floating plant are very commonly found in the lake. The area is characterised by Sahel Savannah vegetation of north eastern part of Nigerian in Adamawa to be specific.It is a semi-arid with low rainfall, low humidity and high temperature. The area experiences two distinctive wet and dry seasons. The rain season starts from May to October, while the dry season commences from November to April and mean daily temperature fluctuates with season normally from 25ºC to 45ºC, and mean annual rainfall received from the range of 150-1000m. Cold and dusty weather is from December to January and then followed by intense heat of March to April. The climate is characterised by high evaporation especially during the dry season.

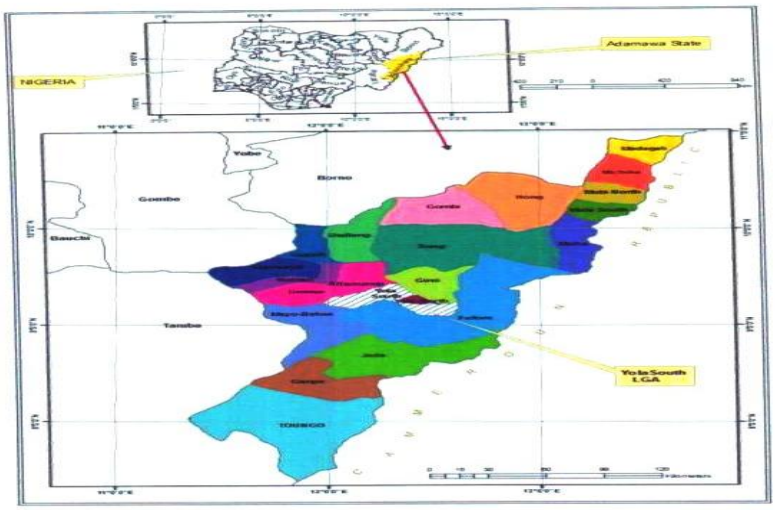


Figure 1. Map of Adamawa State Showing the Location of Njuwa lake.

Sample collection

Water, sediment, plant and fish samples were collected from various sites of the lake (Figure 1). Sample were collected from surface parts of the water and sediment. Also, each sampling was carried out in three replicates, so as to enable statistical analysis. A total of 12 sample each of sediment and water were collected randomly. Two common species of fishes were collected from the fishermen in the lake Njuwa during study period. One species of these was omnivore *Tilapia galilae* and the other was carnivore *Clariasgariepinus.* The fishes selected were among the fish species commonly found in the lake Njuwa.

Extraction of Water Sample

Liquid-liquid extraction of organochlorine pesticide residues in water samples was carried out using Method 3510 as described by [17] was used to extract organochlorine pesticide residues from the water samples. 50 mL of dichloromethane (DCM) was introduced into a separating funnel containing 100 mL of the water sample and shaken vigorously for 5 minutes. The sample was allowed to settle for 30 minutes to facilitate effective separation of the organic and aqueous phases. After separation, the organic layer was filtered into a 250 mL volumetric flask through anhydrous sodium sulphate (Na_2SO_4) that has been prewashed with DCM. The extraction was repeated twice using 50mL of dichloromethane (DCM). The extracts were later combined to make a whole. The extracts were concentrated to 5 mL using a rotary evaporator at a temperature of 45°C, during concentration the solvent is exchanged with n-hexane. The level of organochlorine pesticide residues in the water samples was determined using gas chromatography coupled with a mass spectrometer (GC-MS).

Extraction of Sediment Sample

Solid-liquid extraction of organochlorine pesticide residues in the sediment samples was carried out using the EPA 3550C method as described by [17].A mixture of 20g of sediment samples and 20 g of anhydrous sodium sulphate (Na_2SO_4)was thoroughly mixed with a mixture of 50mL acetone and n-hexane (1:1 v/v). The mixture was sonicated for 30 minutes in a high frequency ultrasonic bath at 60°C, the organic extract was decanted. The extraction process was repeated twice using 50 mL of a mixture of acetone and n-hexane (1:1 v/v). The extracts were later combined to make a whole. The extracts were concentrated using a rotary evaporator at a temperature of 45°C.

Clean up procedure

The cleanup procedure is required for the pesticide residues analysis in sediment sample in order to avoid interferences. The extracts from the sediment samples were clean up using acolumn packed with 2 g of octadecyl (C_{18}) modified silica gel and 2 g of anhydrous sodium sulphate (Na_2SO_4). Prior to the cleanup, the column was conditioned with 20 mL of n-hexane. The extract was introduced into the column and eluted using a mixture of n-hexane and diethyl ether (1:1 v/v). The elute was concentrated to 5 mL using a rotary evaporator at a temperature of 45°C, during concentration the solvent is exchanged with n-hexane.

Gas chromatographic conditions

The following instrumentals conditions were maintained. Gas pressure was 60 psi and injector temperature was 220°C, GC column temperature was 190°C, detector temperature was 270°C, the carrier gas was nitrogen (at 30 ml/min), column length 200 cm, id 2 mm, the glass spiral column packed with 1.5% 0V – 17 and 1.95% 0V-210 on chromosorb WHP 80/100 mesh. There were no peaks when solvents and blanks were chromatographed, before the samples were analyzed under the same condition. Known standards, were alsochromatographed, the retention time were used to identify the compounds present in the samples.

Data analyis and calculations

The following informations were provided for data analysis and calculation of pesticides residues concentrationsfor aqueous and non-aqueous samples matrices.

Concentration (µg/l) = $\frac{(A_x)\ (V_t)(D)}{(\overline{CF})(V_i)(V_s)}$

Where:

A_x = Area (or height) of the peak for the analyte in the sample.

V_t = Total volume of the concentrated extract (µL).

D = Dilution factor, if the sample or extract was dilluted prior to analysis. If no dillution was made, D=1. The diluted factor is always dimensionless.

$\overline{CF}$ = Mean callibration factor from the initial calibration (area/ng).

V_i = volume of ther exact injected (µL). The injection volume for sample and callibration starndards should be the same, unless the analyst can demostrate acceptable performance using different volume or conditions.
V_s = volume of the aqueous sample extracted im mL. If units of liters are used for this term, multiply the result by 1000.
Using the unit given here for these terms will result in a concentration in units of ng/ml, which is equivalent to µg/L.

Fumular For Non- Aqueous solid samples

Concentration (µg/g) = $\frac{(A_x)\,(V_t)(D)}{(\overline{CF})(V_i)(W_s)}$

Where A_x, V_t, D, $\overline{CF}$ and V_i are the same for aqueous sample, and
W_s = weight of the sample extracted (g). The wet weight or dry weight may be used, depending upon the specific application of the data. If units of kilograms are used for this term, multiply the result by 1000.

III. Results

Table 1: Present the Concentration in (µg/l) of pesticide residue in *water sample at Njuwa Lake sampling site.*

Pesticide residue	Types of residue	Molecular Formula	Molecular mass	RT (min)	Concentration (µg/l)
Simazine	Herbicide	$C_7H_{12}ClN_5$	201	6.25	0.41
Trifluralin	Herbicide	$C_{13}H_{16}F_3N_3O_4$	335	ND	Nil
Alpha-BHC	Insecticide	$C_6H_6Cl_6$	290	7.26	0.57
Endrin	Insecticide	$C_{12}H_8Cl_6O$	380	9.64	0.82
Isofenphos-methyl	Insecticide	$C_{14}H_{22}NO_4PS$	331	ND	Nil
Attrazine	Herbicide	$C_8H_{14}ClN_5$	215	ND	Nil
Diazinon	Insecticide	$C_{12}H_{21}N_2O_3PS$	304	10.99	0.19
Carbaryl	Insecticide	$C_{12}H_{11}NO_2$	201	14.15	0.37
Endosulfan 1	Insecticide	$C_9H_6Cl_6O_3S$	406	14.61	0.92
Endoulfan II	Insecticide	$C_9H_6Cl_6O_3S$	406.91	ND	Nil
Di-allate	Herbicide	$C_{10}H_{17}C_{l2}NOS$	270	16.17	0.55
Diphenamid	Herbicide	$C_{16}H_{17}NO$	239	ND	Nil
Cypermethrin	Insecticide	$C_{22}H_{19}C_{l2}NO_3$	416	19.17	0.15
Fluopicolide	Fungicide	$C_{14}H_8C_{l3}F_3N_2O$	383	ND	Nil
Butachlor	Herbicide	$C_{17}H_{26}ClNO_2$	311	20.75	0.28
Metamitron	Herbicide	$C_{10}H_{10}N_4O$	202	ND	Nil
Metabenzthiazuron	Herbicide	$C_{10}H_{11}N_3O_5$	221	ND	Nil

ND = Not Detected, RT = Retantion Time

The result for the Concentration in (µg/g) of pesticide residue in *Sediment Southern sampling site* is presented in**Table 2**

Pesticide residue	Types of residue	Molecular Formular	Molecular mass	RT (Min)	Concentration (µg/g)
Simazine	Herbicide	$C_7H_{12}ClN_5$	201	ND	Nil
Trifluralin	Herbicide	$C_{13}H_{16}F_3N_3O_4$	335	ND	Nil
Alpha-BHC	Insecticide	$C_6H_6Cl_6$	290	ND	Nil
Endrin	Insecticide	$C_{12}H_8Cl_6O$	380	ND	Nil
Isofenphos-methyl	Insecticide	$C_{14}H_{22}NO_4PS$	331	ND	Nil
Attrazine	Herbicide	$C_8H_{14}ClN_5$	215	ND	Nil
Diazinon	Insecticide	$C_{12}H_{21}N_2O_3PS$	304	ND	Nil
Carbaryl	Insecticide	$C_{12}H_{11}NO_2$	201	11.07	1.21
Endosulfan 1	Insecticide	$C_9H_6Cl_6O_3S$	406	ND	Nil
Endosulfan II	Insecticide	$C_9H_6Cl_6O_3S$	406.91	ND	Nil
Di-allate	Herbicide	$C_{10}H_{17}C_{l2}NOS$	270	16.29	1.07
Diphenamid	Herbicide	$C_{16}H_{17}NO$	239	ND	Nil
Cypermethrin	Insecticide	$C_{22}H_{19}C_{l2}NO_3$	416	19.17	1.03
Fluopicolide	Fungicide	$C_{14}H_8C_{l3}F_3N_2O$	383	20.74	0.91
Butachlor	Herbicide	$C_{17}H_{26}ClNO_2$	311	ND	Nil
Metamitron	Herbicide	$C_{10}H_{10}N_4O$	202	ND	Nil
Metabenzthiazuron	Herbicide	$C_{10}H_{11}N_3O_5$	221	ND	Nil

ND = Not Detected, RT = Retantion Time

Table 3:present the Concentration (µg/g) of pesticide residue in *Sediment Northern sampling site* of Njuwa Lake.

Pesticide residue	Types of residue	Molecular Formular	Molecular mass	RT (Min)	Concentration (µg/g)
Simazine	Herbicide	$C_7H_{12}ClN_5$	201	ND	Nil
Trifluralin	Herbicide	$C_{13}H_{16}F_3N_3O_4$	335	ND	Nil
Alpha-BHC	Insecticide	$C_6H_6Cl_6$	290	ND	Nil
Endrin	Insecticide	$C_{12}H_8Cl_6O$	380	ND	Nil
Isofenphos-methyl	Insecticide	$C_{14}H_{22}NO_4PS$	331	ND	Nil
Attrazine	Herbicide	$C_8H_{14}ClN_5$	215	ND	Nil
Diazinon	Insecticide	$C_{12}H_{21}N_2O_3PS$	304	10.31	1.07
Carbaryl	Insecticide	$C_{12}H_{11}NO_2$	201	ND	Nil
Endosulfan 1	Insecticide	$C_9H_6Cl_6O_3S$	406	ND	Nil
Endosulfan II	Insecticide	$C_9H_6Cl_6O_3S$	406.91	16.24	0.92
Di-allate	Herbicide	$C_{10}H_{17}C_{l2}NOS$	270	ND	Nil
Diphenamid	Herbicide	$C_{16}H_{17}NO$	239	ND	Nil
Cypermethrin	Insecticide	$C_{22}H_{19}C_{l2}NO_3$	416	ND	Nil
Fluopicolide	Fungicide	$C_{14}H_8C_{l3}F_3N_2O$	383	ND	Nil
Butachlor	Herbicide	$C_{17}H_{26}ClNO_2$	311	ND	Nil
Metamitron	Herbicide	$C_{10}H_{10}N_4O$	202	ND	Nil
Metabenzthiazuron	Herbicide	$C_{10}H_{11}N_3O_5$	221	ND	Nil

ND = Not Detected, RT = Retantion Time

Table 4: Presents the Concentration in (µg/g) of pesticide residue in *Sediment Western sampling site* ofNjuwa lake

Pesticide residue	Types of residue	Molecular Formular	Molecular mass	RT (Min)	Concentration (µg/g)
Simazine	Herbicide	$C_7H_{12}ClN_5$	201	ND	Nil
Trifluralin	Herbicide	$C_{13}H_{16}F_3N_3O_4$	335	ND	Nil
Alpha-BHC	Insecticide	$C_6H_6Cl_6$	290	ND	Nil
Endrin	Insecticide	$C_{12}H_8Cl_6O$	380	ND	Nil
Isofenphos-methyl	Insecticide	$C_{14}H_{22}NO_4PS$	331	ND	Nil
Attrazine	Herbicide	$C_8H_{14}ClN_5$	215	ND	Nil
Diazinon	Insecticide	$C_{12}H_{21}N_2O_3PS$	304	ND	Nil
Carbaryl	Insecticide	$C_{12}H_{11}NO_2$	201	13.51	0.85
Endosulfan 1	Insecticide	$C_9H_6Cl_6O_3S$	406	ND	Nil
Endosulfan II	Insecticide	$C_9H_6Cl_6O_3S$	406.91	15.51	0.73
Di-allate	Herbicide	$C_{10}H_{17}C_{l2}NOS$	270	16.37	0.81
Diphenamid	Herbicide	$C_{16}H_{17}NO$	239	ND	Nil
Cypermethrin	Insecticide	$C_{22}H_{19}C_{l2}NO_3$	416	18.15	1.03
Fluopicolide	Fungicide	$C_{14}H_8C_{l3}F_3N_2O$	383	ND	Nil
Butachlor	Herbicide	$C_{17}H_{26}ClNO_2$	311	ND	Nil
Metamitron	Herbicide	$C_{10}H_{10}N_4O$	202	ND	Nil
Metabenzthiazuron	Herbicide	$C_{10}H_{11}N_3O_5$	221	28.03	1.21

ND = Not Detected, RT = Retantion Time

Table 5:present Concentration of pesticide residue in (µg/g) in *Sediment obtain from - Eastern sampling site of Njuwa Lake.*

Pesticide residue	Types of residue	Molecular Formular	Molecular mass	RT (Min)	Concentration (µg/g)
Simazine	Herbicide	$C_7H_{12}ClN_5$	201	ND	Nil
Trifluralin	Herbicide	$C_{13}H_{16}F_3N_3O_4$	335	ND	Nil
Alpha-BHC	Insecticide	$C_6H_6Cl_6$	290	ND	Nil
Endrin	Insecticide	$C_{12}H_8Cl_6O$	380	ND	Nil
Isofenphos-methyl	Insecticide	$C_{14}H_{22}NO_4PS$	331	10.44	0.93
Attrazine	Herbicide	$C_8H_{14}ClN_5$	215	ND	Nil
Diazinon	Insecticide	$C_{12}H_{21}N_2O_3PS$	304	ND	Nil
Carbaryl	Insecticide	$C_{12}H_{11}NO_2$	201	ND	Nil
Endosulfan 1	Insecticide	$C_9H_6Cl_6O_3S$	406	ND	Nil
Endosulfan II	Insecticide	$C_9H_6Cl_6O_3S$	406.91	16.14	0.82
Di-allate	Herbicide	$C_{10}H_{17}C_{l2}NOS$	270	ND	Nil
Diphenamid	Herbicide	$C_{16}H_{17}NO$	239	ND	Nil
Cypermethrin	Insecticide	$C_{22}H_{19}C_{l2}NO_3$	416	18.15	1.03
Fluopicolide	Fungicide	$C_{14}H_8C_{l3}F_3N_2O$	383	ND	Nil
Butachlor	Herbicide	$C_{17}H_{26}ClNO_2$	311	ND	Nil
Metamitron	Herbicide	$C_{10}H_{10}N_4O$	202	ND	Nil
Metabenzthiazuron	Herbicide	$C_{10}H_{11}N_3O_5$	221	ND	Nil

ND = Not Detected, RT = Retantion Time

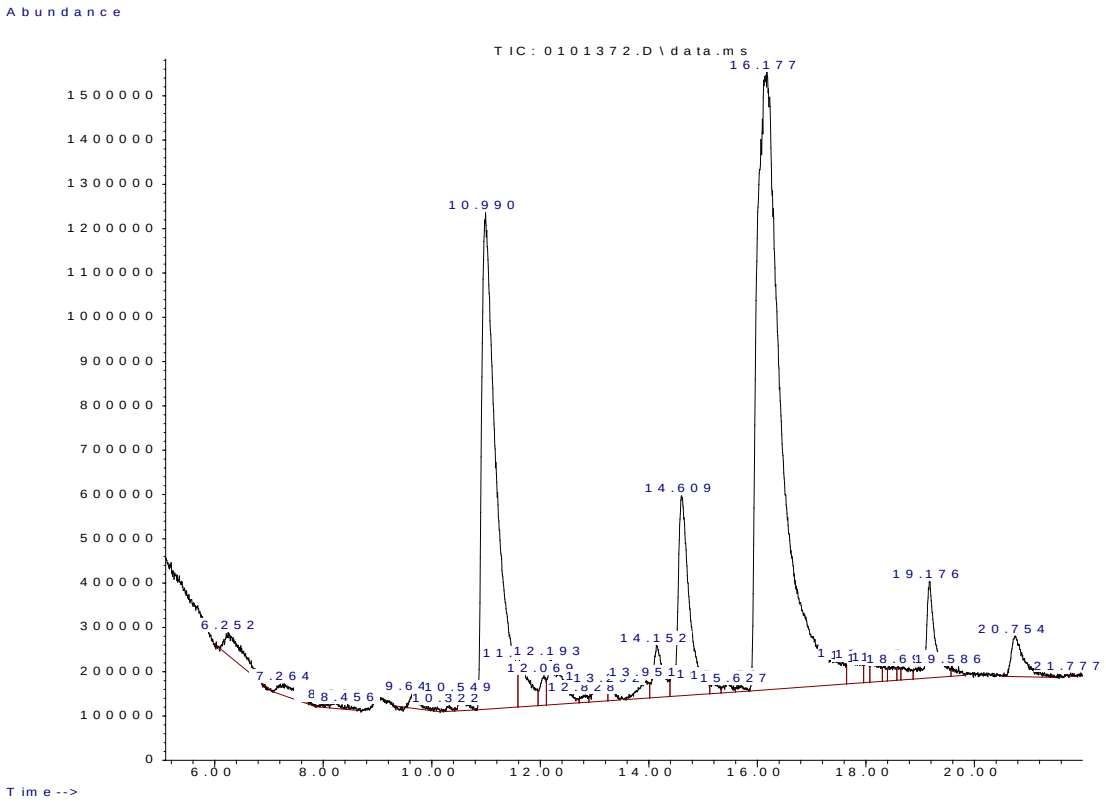


Figure 1: Shows the GC-MS Chromatograms of pesticides residues in water sample in Njuwa Lake, Adamawa state.

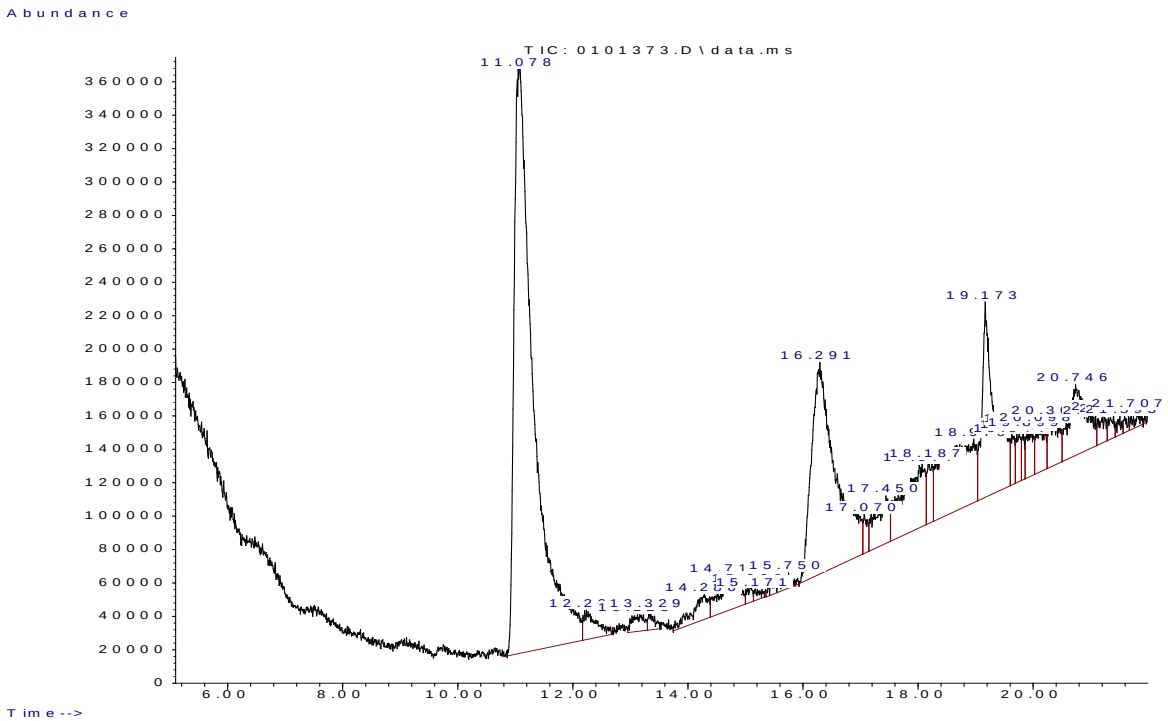


Figure 2: present the GC-MS Chromatograms of pesticides residues obtained from the Sediment sample in the South area of Njuwa Lake.

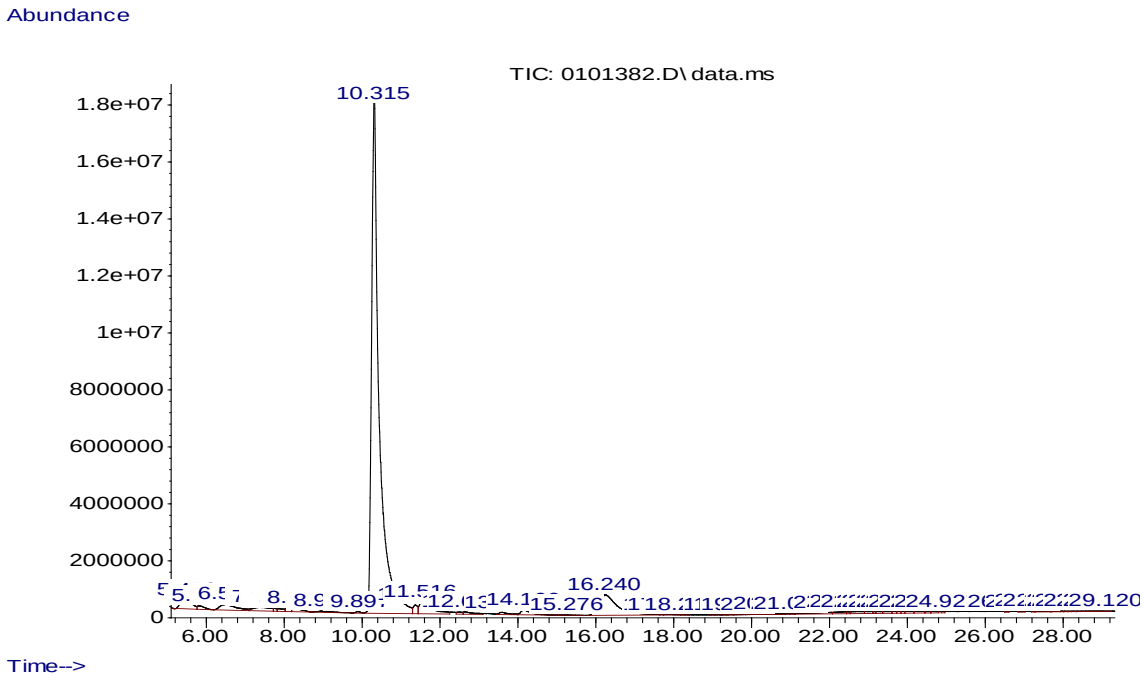
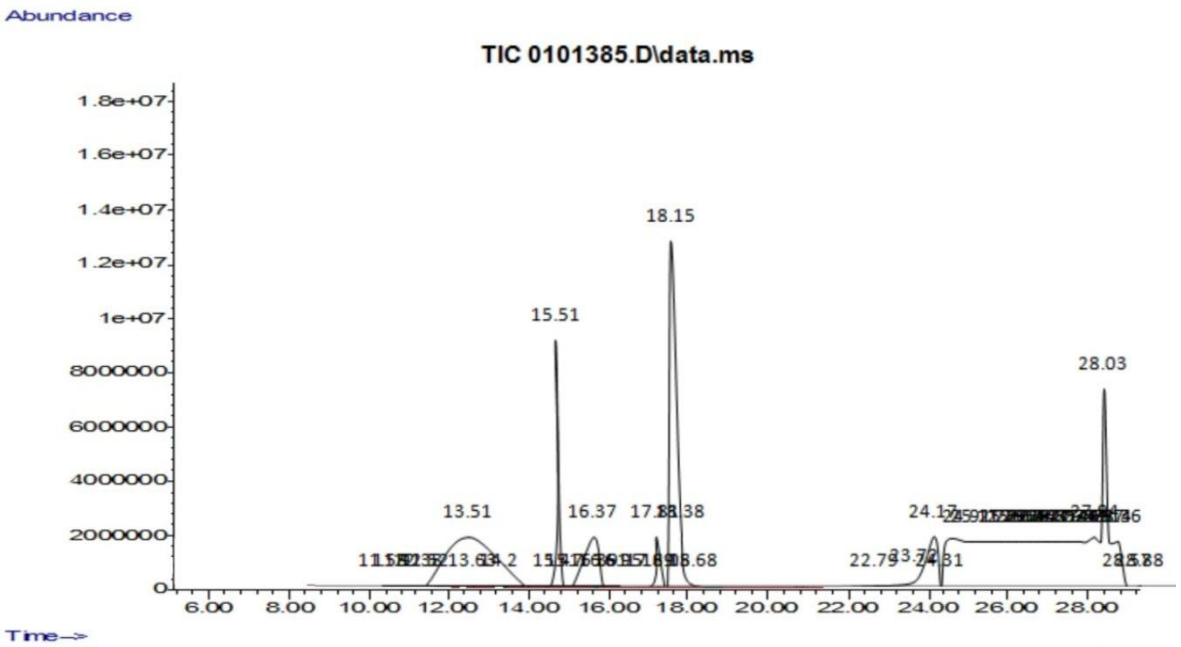


Figure 3: Is the GC-MS Chromatograms of pesticides residues in sediment sample obtain in the North area of Njuwa Lake.



The GC-MS Chromatograms of pesticides residues in sediment sample in the west area of Njuwa Lake, is presented in **figure 4.**

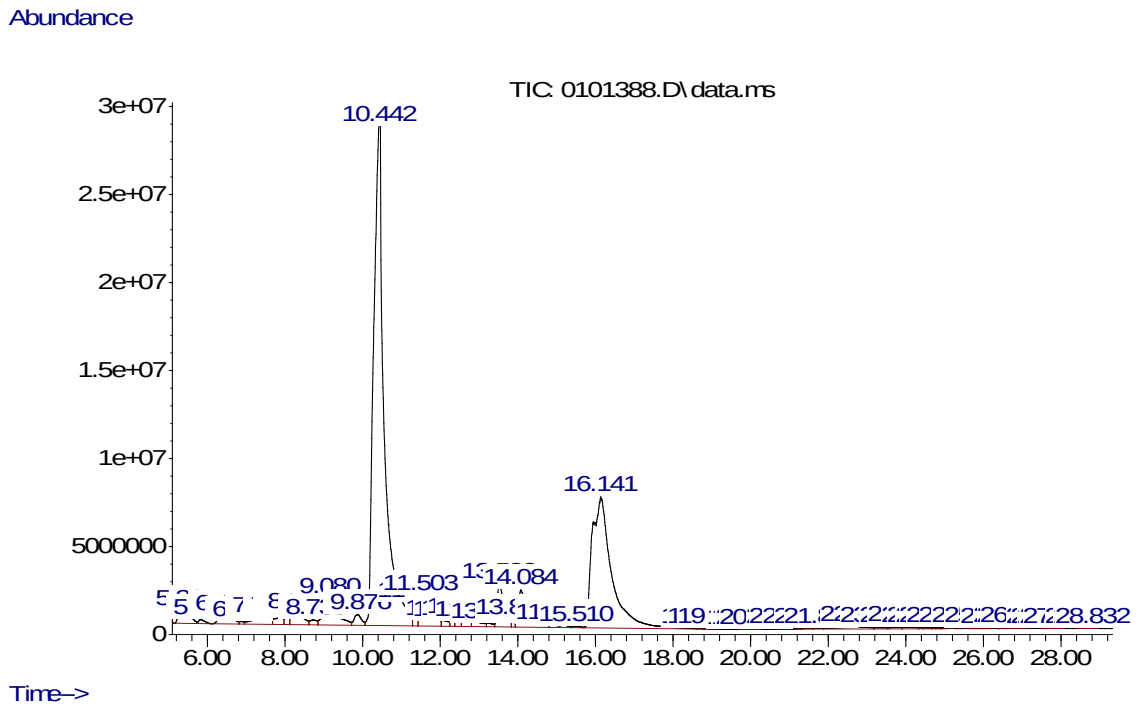


Figure 5 is the GC-MS Chromatograms of pesticide residues in sediment sample in the East area of Njuwa Lake.

IV. Dicussion

Table 1 and shows result and discussion of the occurrence and concentration of pesticides residue detected in the water samples collected at the four sampling points in the lake of Njuwa, Adamawa state. Out of nine pesticides determined, six were insecticides namely: alpha-BHC, Endrin, Diazinon, Carbaryl, Endosulfan 1 and Cypermethrin. Only three herbicides were detected which include Simazine, Di-allate, and Butachlor respectively. Insecticides that were present in higher concentration in the surface water were Endosulfan 1 (0.92µg/l), Endrin (0.82µg/l), alpha-BHC (0.57µg/l), carbaryl (0.37µg/l), Diazinon (0.19µg/l) and Cypermethrin (0.15µg/l). However, in herbicides Di-allate was detected (0.55µg/l), simazine (0.41µg/l) and butachlor (0.28µg/l).

The higher concentration of Endosulfan 1 detected in the water sample relative to those of Endosufan II may be attributed to the following reasons: Firstly, the manufactured technical endosulfan normally contains about 67% endosulfan 1 by weight of the total endosulfan content, while endosulfan II constitutes only32 % [18]. It is therefore, not unexpected that more of endosulfan would be found in the environment when the pesticide is applied. Secondly, endosulfan 1 is thermally stable, while endosulfan II is unstable and is converted to endosulfan 1 in the environment [17].

However, the high concentration of endosulfan 1 compounds in the water sample may be an indication of recent application of the pesticide, as endosulfan 1 is easily degraded and does not accumulate in the environment like most other organo-chlorines [5]

Endrin, alpha-BHC, Carbaryl, Diazinon, cypermethrin, Di-allate, simazine and Butachlor were also detected in the water sample. The different concentrations found suggest that the pollution of the water emanates from diverse non-point sources, and possibly from varied applications of pesticides on the farms in the area.

The Concentration of Pesticide Residue in Aquatic Sediment samples are presented in tables 2,3,4,5 and figures 2,3,4 and 5 and their various retention time. The pesticides residue detected in the samples at various locationsdiffer markedly. However, concentration of each compound within the same phase of the environment appear to be of similar order of magnitude. Sediments from southern sampling site had the following concentration for each pesticide residue. Di-allate (1.07µg/g), carbaryl (1.21µg/g), Cypermethrin (1.03µg/g), and Fluopicolide (0.91µg/g).

Sampling in Northern site of the lake, pesticide residue concentrations were found as follows: Diazinon (1.07µg/g), and Ednosulfan II (0.62µg/g) respectively.

Concentrations of pesticide residue in the location of Western site of the lake showed as follows: Carbaryl (0.85µg/g), Endosulfan II (0.73µg/g), Di-allate (0.81µg/g), Cypermethrin (1.03µg/g) and methabenzthiazuron (1.21µg/g) respectively.

Finally, in Eastern direction of the sampling site, the concentration of pesticide residue followed the order: isofenphosmethyl (0.94µg/g) and Endosulfan II (0.82µg/g) respectively. The presence of these pesticides in sediment samples from the lake of Njuwa is indicative of possible contamination of the lake through various anthropogenic sources especially agriculture. It was also observed that the concentration of pesticide residue in this study were higher than the recommended guideline values for pesticide residue set by [18].

From the results, it is convincing to state that farmers were not following proper precautions with regards to the use of pesticides in appropride dosages and standard prescribed by the manufacturers. Consequently, samples of water and sediments at the study sites of the lake Njuwa were contaminated with pesticides residues. The high concentration of pesticide residues in the water and sediment samples have indicated that this pesticide have being used indiscriminatly and as concequence could result to toxicity at higher level causing an advers health effect not only to the farmer but also to the general consumer of fish in the lake. The over dependence of pesticide especially in agriculture has created a serios problem. [13,14]reported that the highly dependency on the pesticide was simply to adress pest problem and also is the only viable option left for pest control.

The presence of high pesticide residues espectially in the bottom sediment of lake Njuwa indicate the need for continuous monitoring of the lake and it vecinity in order to save guard the health and safety of the farmers and the general community and Surrounding area. However continuous monitoring procedures need to be put in to place to develop strategies for pesticide reduction and through agricultural traning program. The WHO/FEPA guide line on pesticide residues should be at adhered in order to reduce polution load to both water and sediment.Adherance to pesticide instructions such as lebels, safety, storage and packaging need to be carefully studied before application [12,17,18]. It is also important to raise awareness among the general public who may be directly or indireclty exposed to pestcides.

V. Conclusion

This study has presented information on the different pesticides residues contamination and their levels in water and sediment in lake Njuwa Yola, Adamawa State. Carbaryl, Di-allate and cypermethrin was found frequently in the water and sediment,which is believed to be connected with the high concentations of the compounds as was found out from this studies.

The results also showed that the concentations of the pesticides residues in the lake is associated with the pollution load from diverse non-point sources. The high concentrations of the pesticides found in the water and sediment could pose a risk to human and aquatie life.This could also be pointer indicating wrong use of the aforementioned pesticides in the vicinity of the lake Njuwa. This work will provide a reference with which future levels of pesticides resideus in the lake, could be assesed and monitored.

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