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PREVALENCE AND ECOLOGICAL RISK OF POLYCHLORINATED BIPHENYLS (PCBS) IN AGRICULTURAL SOILS OF DADIN KOWA DAM BASIN, GOMBE STATE NIGERIA

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ABSTRACT

Pesticide residues are "forever chemicals" considered to be pollutants of environmental and human health. The study was aimed at analysing the PCBs pesticides residue composition of four different soil samples from selected areas of Dadin kowa Dam Basin where agricultural activities dominated their occupation. Physicochemical parameters such as the pH of soil samples were analysed and showed pH values range from 7.54 in Sb3 to 7.21 in Sb2. The conductivity of the soil sample ranging from 337.25 µScm-1 inSb4 to 178 µScm-1 in Sb3.The soil texture analysis investigated showed Sb1 has the highest percentage of sand with 44.44% and soil sample Sb2 has highest percentage of slit soil at 40.90% while soil sample Sb4 has the highest percentage of clay soil with 41.66%. The PCBs composition of soil samples was determined showed that 2,2,3,4,4,5,6-Heptachlorobiphenyl in sample Sb3 revealed highest composition of 0.25 ppm concentration while 2-Chlorobiphenyl in all samples Showed the least composition of 0.00 ppm concentration. The result of soil the analysed at Dadinkowa Dam Basin was free from threats of pollutants residues investigated except Sb3 soil were below the permissible value range of 0.1 to 0.6 ppm.

Keywords: Pollutants residues, Polychlorinated biphenyls, Soil, Basin, Composition

INTRODUCTION

Polychlorinated biphenyls (PCBs) are collections of many poisonous different industrial chemicals considered to be pollutants of environmental and human health concern. Although PCBs are now ubiquitous in the environment as affluence originated from industrial production with unknown proper natural transport and deposition, current transport, riverine input, sea-ice transport and biotic transport are considered to be the main sources (AMAP, 2004). Polychlorinated biphenyls (PCBs), a class of persistent organic pollutants (POPs), are ubiquitous contaminants indifferent compartments of the environment. PCBs are compounds with a wide range of properties such as vapour pressure, solubility and partition coefficients. Starting from their first commercialization as synthetic organic compounds in nineteenth century, PCBs were manufactured and used extensively in industrial and commercial applications. Equipment and products commonly containing PCBs include transformers, capacitors, paints, printing inks, pesticides, hydraulic fluids and lubricants (Fan *et al*., 2013).

Recent research reported that approximately10000t of PCBs accounted for environmental pollutants that persisted to global menace (Zheng *et al*., 2010). Although the production of PCBs has been banned since the early 1970s in many countries, residual components are still contaminating the fresh water, micro-organism in the environment in general (Sprovieri *et al*..2007). PCBs persisted as legacy pollutants where chronic toxicity threats represent a serious environmental risk due to their stability and permanence (Wang *et al*., 2011). Land and water are the fundamental components of natural resources that underpin the sustainability of agriculture and the existence of human civilization. Regrettably, both these crucial resources have suffered severe degradation owing to a variety of natural processes such as leaching, mineralization, volcanic eruption, and anthropogenic activities such as industrial waste, chemical agriculture, smelting, and mining. The depletion of these vital resources has had significant consequences on the environment, such as soil erosion, water scarcity, and a decline in agricultural productivity and many others. Sustainable practices nowadays adopt measures that mitigate the adverse impact of human activities and safeguard the essential resources for future generations (Begum *et al*., 2021). .The environmental implications of the application of pesticides and other noxious chemicals are contingent upon their interaction with soil particles. The determination of whether the released residues pose a toxicological and ecological risk are vital issue. Critical methods of examination of these factors became the clear thoughtful extent of the impact of these substances on the environment and the potential consequences for human health and the ecosystem (Mukaj *et al*., 2016).

MATERIALS AND METHODS

Study Area

This study was carry out in Dadinkowa area of Yamaltu Deba local government, Gombe State, northeastern Nigeria. Dadinkowa is the second largest commercial center in Gombe state; it is located on the Maiduguri highway eastern of Gombe. It serves as a collecting point for vegetables, Rice and maize are the most commonly grown crops in this area, while Tomatoes and other vegetables such as Pepper and Onion serve as cash crops. The predominant inhabitants of the area that participated actively in Agricultural activities are the Fulani, Tera, and Hausa peoples of the surrounding area.

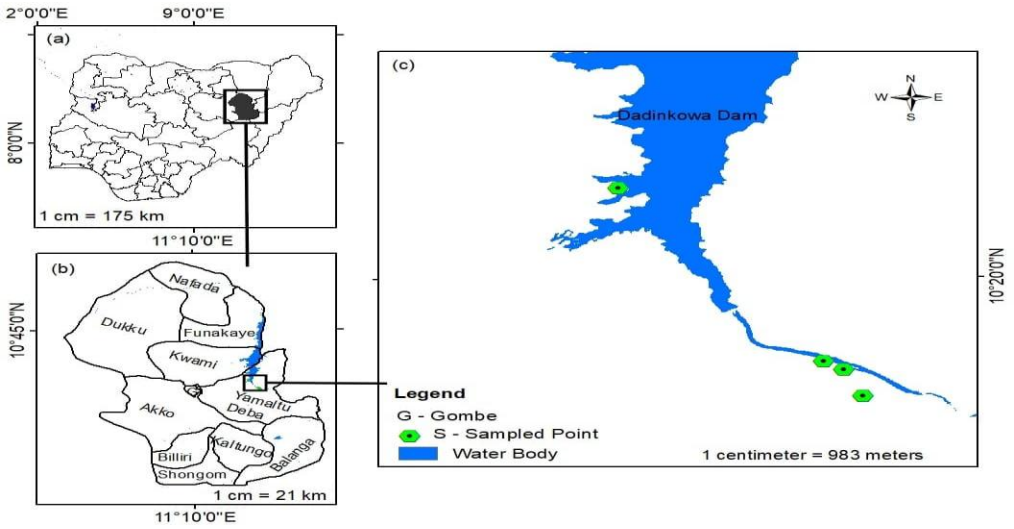

Figure 1: Map of the Study Area Showing Sampling Locations

Sample Collection

The soil sample was collected at four different locations within the outskirts of Dadinkowa Town where Agricultural activities served as their dominant occupation, The sampling points are labeled as; Sb1= Dadin kowa water treatment plant, Sb2= Near Cattle market Dadin kowa, and Sb3 =Tunga Dadin kowa Farmlands and Sb4= near Horticulture Dadin kowa. Soil samples are collected at each sampling point mentioned above from the surface layer of the soil at a depth of about (0-30 cm) as adopted with slight modifications by Usman *et al*., (2024).

Extraction of Pesticide Residues from Soil Samples

Mixtures of individual samples of 2g of soil sample and 4g of granular sodium sulphate was ground into a powder with a mortar and pestle. The samples were extracted with 20 cm^3 of a mixture of n- Hexane and acetone (1:2). The extract was poured into a round bottom flask and about 20 cm^3 and heated on a water bath at a constant temperature of 50 °C to 55 °C. The concentrated solvent extract was evaporated with a rotary evaporator to least 5 cm^3. The concentrated solvent extract was accurately poured into a centrifuge tube, concentrated with a Nitrogen evaporator to 0.5 cm^3 and diluted with 2 cm^3 of n-hexane before being taken to GC-MS for analysis as described by Modibbo *et al*., (2024).

Analysis of pH Values of Soil /Sediments

About 2g of air dried soil samples were accurately weighed individually and placed into 250 cm^3 respected beakers and 20 cm^3 of distilled water was added to each sample beaker. It was stirred with a glass rod and shaken moderately allowed that they became homogenous mixtures. A pre –calibrated pH meter (3150 Jenway) was inserted into each slum mixture and pH values were recorded as adopted by (Usman *et al*., 2024).

Determination of Ash Content

This method measured the residue of soil samples left after heating in an oven. The method adopted was with slight modifications, where 2g of the powdered sample was weighed (W1) into pre-weighed empty crucible (Wo) and placed into a muffle furnace until the sample was completely ashes at temperature 600ºc. The ash was removed and cooled in desiccators and weighed (W2).The weight of the ashes sample was determined by percentage of ash between the ashes sample and pre-weighed crucible. Ash was calculated by the formula (Usman *et al*., 2024).

$$\% \text{ Ash} = \frac{W2\text{-}Wo}{W1\text{-}wo} \text{ X } 100 \quad (1)$$

Conductivity Test of Samples

Exactly 5g each of the samples was shaken and 50 cm^3 of distilled water was poured into an extraction bottle with mechanical shaker for 1hr. The mixture formed a suspension which was filtered twice that removed turbidity and two drops of 0.1% Na_2PO_3 was added to the filtrate. Probe of conductivity meter was inserted and values are recorded in $NScm^{-1}$as adopted by Usman *et al*., (2015).

Soil Texture Analysis

Mesh sieve or old colander was used and soil was shaken which removed all debris, rocks, and large organic matter (leaves, sticks, roots, etc.). The jar full with one third portion of the soil to be tested. The reaming portion of the jar was filled with clean water, with small space was left at the top. Then jar was coked and shaken vigorously until the soil turned into uniform slurry that indicated on a level surface at time for one minute. Mark was written outside of the jar that showed the coarse sand layer settled at the bottom of the jar. The jar was allowed to settle for 2 hours while level spots were formed. Also the top of the next settled layer with the permanent marker was marked "This was named the silt layer". The jar was also left to settle for 48 hours that formed level spot, top of the next settled layer was marked again with the permanent marker "This clay layer" has settled on top of the silt layers. The ruler was used to measured and record the height of each layer and the total height of all three layers was recorded as stated by Usman *et al*., (2024).

RESULTS AND DISCUSSION

pH Values of Soil Samples

The mean pH values of sample soil investigated showed that Sb3 has 7.54 as followed by Sb1 with pH value of 7.33, followed by Sb4 with pH value of 7.30 while Sb2 showed the lowest pH value of 7.21. This showed that the acidity value increase in the order as Sb3= 7.54 > Sb1= 7.33 > Sb4= 7.30 > Sb2= 7.21 respectively. The result obtained revealed that soil investigated were neutral which contradicted the findings of soil pH values range of S2=5.20 > S1 = 5.95 > S3 = 6.01 as reported by Usman *et al*., (2024). Also the result obtained contradicted the pH mean values range from 4.77 to 4.99 as reported by Yusuf *et al*., (2024).

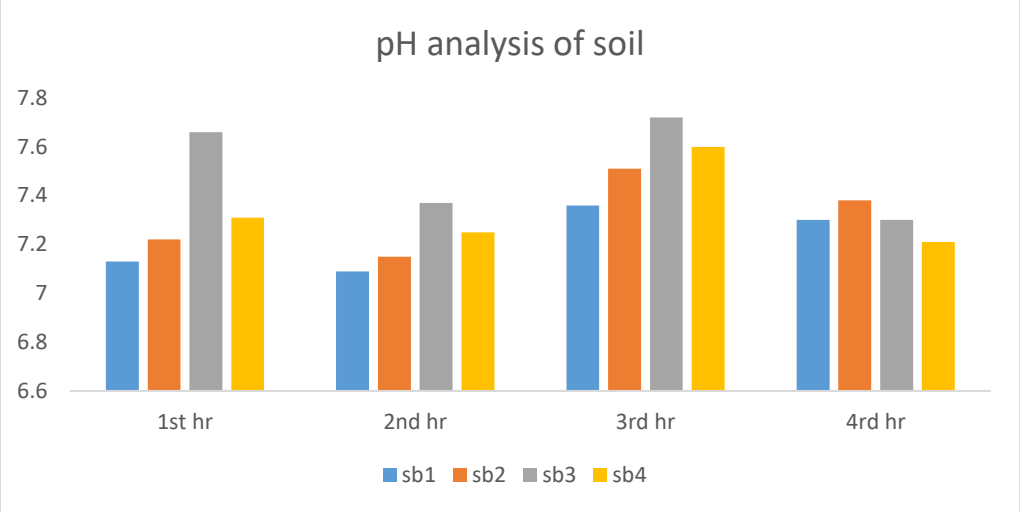

Figure 2: pH Values of Soil Samples

Conductivity Test of Soil

The result on Figure 3 showed that Sb4 has the highest conductivity of 337.25 µScm^{-1} followed by Sb2 with conductivity of 281 µScm^{-1} followed by Sb1 with conductivity of 260 µScm^{-1} while Sb3 showed the least conductivity of 178 µScm^{-1} respectively. This indicated that the value decrease in the order as Sb4 = 337.25 µScm^{-1} > Sb2 = 281µScm^{-1} > Sb1 =260 µScm^{-1} > Sb3 = 178 µScm^{-1} accordingly. The result obtained showed has moderate electrical conductivity value which was lower in a conductivity value range of 0.23 to 0.26 µScm^{-1} as reported by Usman et al., (2024).

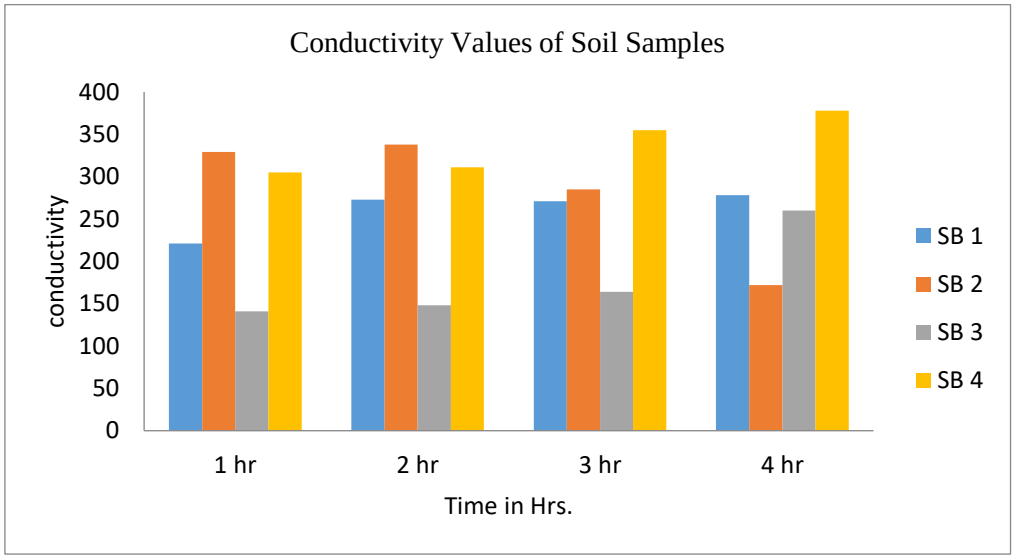

Figure 3: Conductivity Values of Soil

Soil Texture Analysis

Three soil samples were analyzed and the result was shown as follows; Measurements conducted on Sample Sb1 showed a Height of sand layer = 0.8 cm while Height of silt layer = 0.7 cm, height of the clay layer = 0.3 cm. Total height of layers = 1.8 cm, the percentage layers displayed after investigation was calculated using the formula = % sand = Sand height / Total height X 100% result show as; % Sand = 44.44% % Slit = 38.88%
% Clay = 16.66%.

Sample Sb2 sample was analyzed and the result was shown as follows; Measurements conducted on Sample B showed a height of the sand layer = 0.8 cm while height of silt layer = 0.9 cm, height of the clay layer = 0.5 cm. Total height of layers = 2.2 cm, the percentage layers displayed after investigation was calculated using the formula: % sand = Sand height / Total height X 100% and results obtained showed; % Sand = 36.36%
% Silt = 40.90% % Clay = 22.72%

Sample Sb3 was analyzed and the result obtained was shown as follows; Measurements conducted on Sample C showed a height of sand layer = 1.0 cm while height of silt layer = 0.9 cm, height of the clay layer = 0.4 cm. Total height of all layers = 2.3 cm, the percentage layers displayed after investigation was calculated using the formula: % sand = Sand height / Total height X 100 and result shows as
% Sand = 43.47% % Silt = 39.13% % Clay = 17.39%

Sample Sb4 soil was analyzed and the results obtained was shown as follows; Measurements conducted on Sample C showed a height of sand layer = 0.8 cm while height of silt layer = 0.6 cm. Height of the clay layer = 1.0 cm. The total height of all the layers = 2.4 cm, the percentage layers

displayed after investigation was calculated using the formula: % sand = Sand height / Total height X 100 and results obtained are shown as;

% Sand = 33.33 % % Silt = 25 % % Clay = 41.66 %

The results obtained on composition of Dadin kowa soil revealed that the percentage Sand Soil was ranged from 33.3 % to 43.47 % > Silt soil which ranged from 25 % to 40.9 % > Clay soil that ranged from 16.6 % to 41.66 %. The result obtained contradicted the soil texture compositions of 31.0 % to 35.7 % as reported by Usman *et al*., (2024).Also the result obtained contradicted the Sand composition which ranged from of 38 % to 52.75 % while Silt soil composition obtained ranged from 35.75 % to 45.75 % and the Clay soil composition obtained ranged from 11.75 % to 14 % as reported by Yusuf *et al*., (2024).

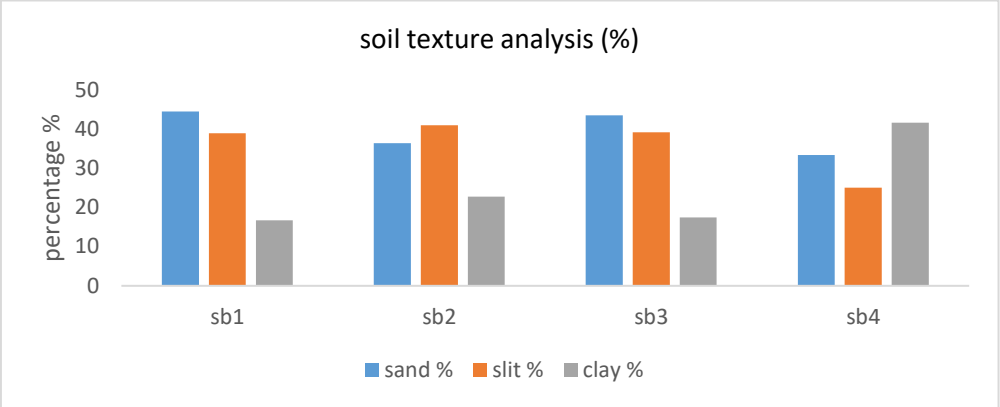

Figure 4: Soil Texture Analysis

PCBs Composition of Sample Sb1

Figure 5 indicated the peaks obtained per components present in sample Sb1 soil, while Table 1 clearly illustrated the presence of seventeen polychlorinated biphenyls. The result obtained showed compositions of PCBs in decreasing order whereby 2,2,3-Trichlorobiphenyl revealed highest composition of 0.07 ppm concentration > 2,3,4,4-Tetrachlorobiphenyl = 0.06 ppm. The trend proceeded by 2,2,3,4,5,5,6-Heptachlorobiphenyl = 0.02 ppm > 2,4,5-Trichlorobiphenyl = 0.02 ppm. In the same trend 2,2,3,3,4,4,5-Heptachlorobiphenyl = 0.01 ppm > 2,2,3,4,5,5-Hexachlobiphenyl = 0.01ppm and 2,2,4,5,5-Pentachlorbiphenyl = 0.01 ppm. The other component of 2, 2, 3, 4, 5-Pentachlorobiphenyl = 0.01 ppm > 2, 2, 5, 5-Tetrachloro biphenyl = 0.001 ppm.

Other polychlorinated biphenyls present in the Sb1 sample of the same trends are 2,2,3,5-Tetrachlorobiphenyl = 0.01 ppm > 2,3-Dichlorobiphenyl = 0.01 ppm > 2,2,3,3,4,4,5,5,6-heptachlorobiphenyl = 0.00 ppm > 2,2,3,4,4,5,6-Heptachlorobiphenyl = 0.00 ppm > 2,2,3,5,5,6-Hexachlobiphenyl > 0.00 ppm > 2,3,3,4,6-Pentachlorobiphenyl > 0.00 ppm followed by 2,2,3,4,4,5-Hexachlobiphenyl = 0.00 ppm > 2-Chlorobiphenyl > 0.00 ppm. The result obtained showed all PCBs concentration in Sb1 ranged of 0.01ppm to 0.07 ppm which contradicted the PCBs in soil ranged from 0.36ng/g to 2.44ng/g as investigated by Lu *et al*., (2017). The result obtained also contradicted the values of PCBs ranged from 82.0 ng/g (4.8 ng/g), to (18.7 ng/g). as reported by Oluwatoyin *et al*., (2014).

Table 1: PCBs of Sb1

Compound	R.T.	QIon	Response	Conc	Units	Dev (Min)	Qvalue
2-Chlorobiphenyl	0.000		0	N.D.			
2,3-Dichlorobiphenyl	5.414	222	212	0.01	ppm	#	1
2,2',5-	6.100	186	1596	0.07	ppm	#	31
2,4',5-	7.044	256	198	0.02	ppm	#	1
2,2',3,5-	6.975	292	189	0.01	ppm	#	1
2,2',5,5'-	7.559	292	228	0.01	ppm	#	1
2,3',4,4'-	8.503	292	511	0.06	ppm	#	1
2,2',3,4,5-	8.657	326	167	0.01	ppm	#	1
2,2',4,5,5'-	9.095	326	190	0.01	ppm	#	1
2,3,3',4',6-	9.215	326	99	0.00	ppm	#	1
2,2',3,4,4',5-	9.207	360	108	0.00	ppm	#	1
2,2',3,4,5,5'-	10.048	360	202	0.01	ppm	#	1
2,2',3,5,5',6-	10.571	360	96	0.00	ppm	#	1
2,2',3,3',4,4',5-	10.931	394	230	0.01	ppm	#	1
2,2',3,4,4',5',6-	11.953	396	83	0.00	ppm	#	1
2,2',3,4',5,5',6-	12.116	394	301	0.02	ppm	#	1
2,2',3,3',4,4',5,5',6-	13.875	464	79	0.00	ppm	#	1

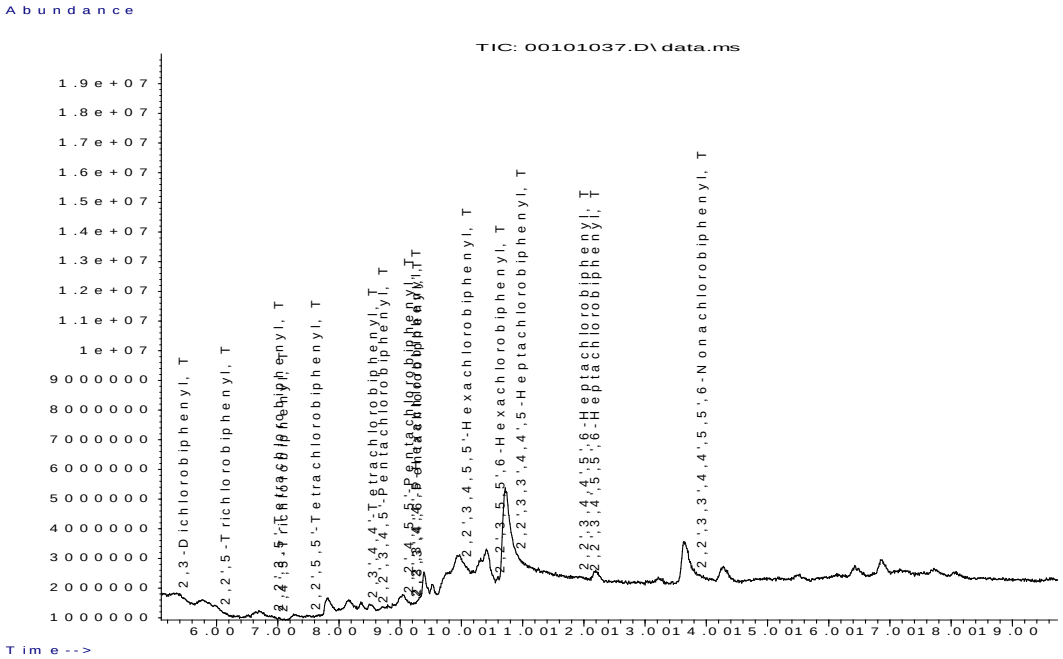

Figure 5: PCBs Composition of Sample Sb1

PCBs Composition of Sample Sb2

Figure 6 indicated the peaks obtained per components present in sample Sb2 soil, while Table 2 clearly illustrated the presence of seventeen polychlorinated biphenyls. The result obtained showed compositions of PCBs in decreasing order whereby 2,2,3,4,5,5,6-Heptachlorobiphenyl revealed highest composition of 0.24 ppm > 2,2,5,5-Tetrachlorobiphenyl = 0.10 ppm > 2,2,3,4,4,5,6-Heptachlorobiphenyl = 0.09 ppm > 2,2,4,5,5-Pentachlorobiphenyl = 0.06 ppm > 2,2,3,3,4,4,5,5,6-nonachlorobiphenyl = 0.04 ppm > 2,2,3,3,4,4,5-Heptachlorobiphenyl = 0.03 ppm > 2,2,5-Trichlorobiphenyl = 0.03 ppm > 2,2,3,4,5,5-Hexachlobiphenyl = 0.02 ppm > 2,2,3,4,4,5-Hexachlorbiphenyl = 0.02 ppm > 2,2,3,4,5-Pentachlobiphenyl = 0.02 ppm > 2,4,5-Trichlorobiphenyl = 0.02 ppm > 2,2,3,5,5,6-Hexachlorobiphenyl = 0.01 ppm. Other polychlorinated biphenyls in the same sequence are 2,3,3,4,6-Pentachlorobiphenyl = 0.01 ppm concentration > 2,3',4,4'-Tetrachlorobiphenyl = 0.01 ppm 2,2,3,5-Tetrachlorobiphenyl = 0.01 ppm > 2,3-Dichlorobiphenyl = 0.01 ppm > 2-Chlorobiphenyl = 0.00 ppm respectively. The result obtained of PCBs composition in Sb2 soil sample ranged from 0.01 ppm to 0.24 ppm which contradicted the PCBs compositions of soil which ranged from 0.36ng/g to 2.44ng/g as investigated by Lu *et al*., (2017). The result obtained also contradicted the values of PCBs ranged from 82.0 ng/g (4.8 ng/g), to (18.7 ng/g). as reported by Oluwatoyin *et al*., (2014).

Table 2: PCBs of Sb2

Compound	R.T.	QIon	Response	Conc	Units	Dev	Qvalue
2-Chlorobiphenyl	0.000		0	N.D.			
2,3-Dichlorobiphenyl	5.405	222	499	0.01	ppm	#	1
2,2',5-	6.100	186	642	0.03	ppm	#	23
2,4',5-	6.795	256	227	0.02	ppm	#	1
2,2',3,5-	7.138	292	136	0.01	ppm	#	1
2,2',5,5'-	7.773	292	2256	0.10	ppm	#	1
2,3',4,4'-	8.546	292	97	0.01	ppm	#	1
2,2',3,4,5-	8.597	326	573	0.02	ppm	#	27
2,2',4,5,5'-	9.069	326	914	0.06	ppm	#	1
2,3,3',4',6-	9.224	326	467	0.01	ppm	#	1
2,2',3,4,4',5-	9.335	360	510	0.02	ppm	#	1
2,2',3,4,5,5'-	10.262	360	382	0.02	ppm	#	1
2,2',3,5,5',6-	10.545	360	268	0.01	ppm	#	1
2,2',3,3',4,4',5-	10.803	394	1054	0.03	ppm	#	1
2,2',3,4,4',5',6-	11.884	396	2102	0.09	ppm	#	1
2,2',3,4',5,5',6-	12.150	394	4608	0.24	ppm	#	49
2,2',3,3',4,4',5,5',6-	13.815	464	779	0.04	ppm	#	1

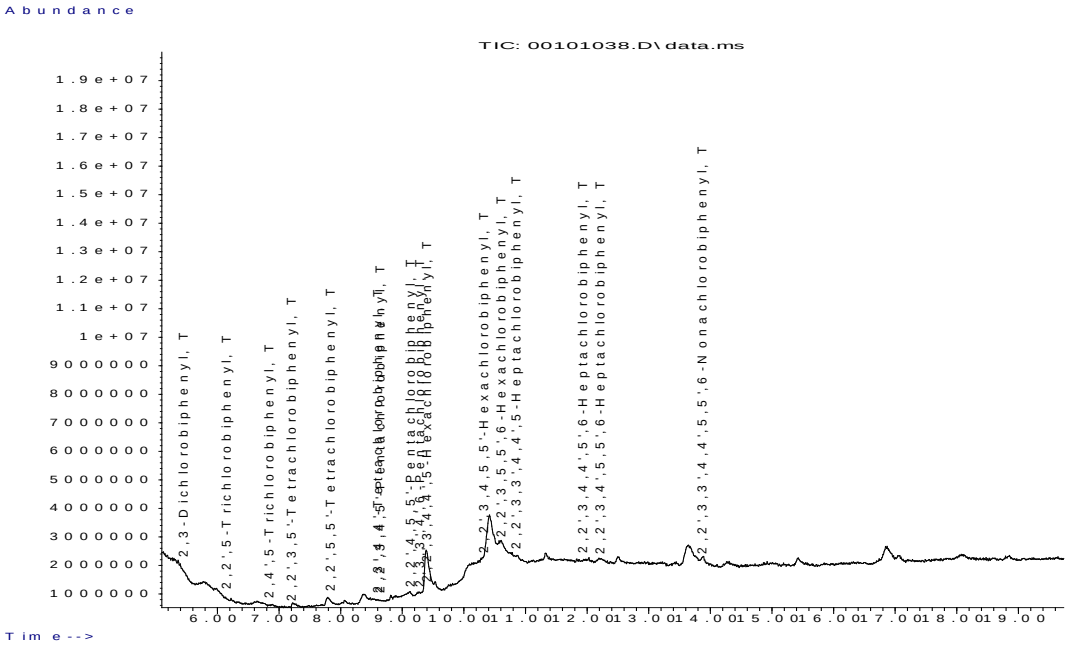

Figure 6: PCBs Composition of Sample Sb2

PCBs Composition of Sample Sb3

Figure 7 indicated the peaks obtained per components present in sample Sb3 soil, while Table 3 clearly illustrated the presence of seventeen polychlorinated biphenyls. The result obtained showed compositions of PCBs in decreasing order whereby 2,2,3,4,4,5,6-Heptachlorobiphenyl revealed highest composition showed 0.25 ppm > 2,2,3,4,5,5,6-Heptachlorobiphenyl = 0.18 ppm > 2,2,3,3,4,4,5-Heptachlorobiphenyl = 0.06 ppm > 2,3,4,4-Tetrachlorobiphenyl = 0.05 ppm > 2,2,5-Trichlorobiphenyl = 0.04 ppm > 2,2,4,5,5-Pentachlorobiphenyl = 0.03 ppm > 2,3-Dichlorobiphenyl = 0.03 ppm > 2,2,3,4,5,5-Hexachlobiphenyl = 0.02 ppm > 2,2,5,5-Tetrachlorobiphenyl = 0.02 ppm > 2,2,3,3,4,4,5,5,6-nonachlorobiphenyl = 0.01 ppm > 2,2,3,5,5,6-Hexachlorobiphenyl = 0.01 ppm > 2,2,3,4,4,5-Hexachlorbiphenyl = 0.01 ppm > 2,2,3,4,5-Pentachlobiphenyl = 0.01 ppm.

Other polychlorinated biphenyls presence in the same sequence are 2,4,5-Trichlorobiphenyl = 0.01 ppm > 2,3,3,4,6-Pentachlorobiphenyl = 0.00 ppm > 2,2,3,5-Tetrachlorobiphenyl with the same value = 0.00 ppm finally 2-Chlorobiphenyl showed 0.00 ppm respectively. The result obtained showed all PCBs composition in Sb3 soil ranged from 0.01ppm to 0.25 ppm which contradicted the PCBs soil composition that ranged from 0.36ng/g to 2.44ng/g as investigated by Lu *et al*., (2017). The result obtained also contradicted the values of PCBs ranged from 82.0 ng/g (4.8 ng/g), to (18.7 ng/g) as reported by Oluwatoyin *et al*., (2014).

Table 3: PCBs of Sb3

Compound	R.T.	QIon	Response	Conc	Units	Dev	Qvalue
2-Chlorobiphenyl	0.000		0	N.D.			
2,3-Dichlorobiphenyl	5.457	222	1266	0.03	ppm	#	1
2,2',5-	6.100	186	861	0.04	ppm	#	14
2,4',5-	6.933	256	111	0.01	ppm	#	1
2,2',3,5-	7.164	292	110	0.00	ppm	#	1
2,2',5,5'-	7.516	292	362	0.02	ppm	#	1
2,3',4,4'-	8.546	292	357	0.05	ppm	#	1
2,2',3,4,5-	8.563	326	175	0.01	ppm	#	1
2,2',4,5,5'-	9.001	326	412	0.03	ppm	#	1
2,3,3',4',6-	9.275	326	138	0.00	ppm	#	1
2,2',3,4,4',5-	9.335	360	193	0.01	ppm	#	1
2,2',3,4,5,5'-	10.288	360	375	0.02	ppm	#	1
2,2',3,5,5',6-	10.605	360	487	0.01	ppm	#	1
2,2',3,3',4,4',5-	10.794	394	2250	0.06	ppm	#	28
2,2',3,4,4',5',6-	11.875	396	5477	0.25	ppm	#	71
2,2',3,4',5,5',6-	12.193	394	3384	0.18	ppm	#	20
2,2',3,3',4,4',5,5',6-	13.823	464	204	0.01	ppm	#	1

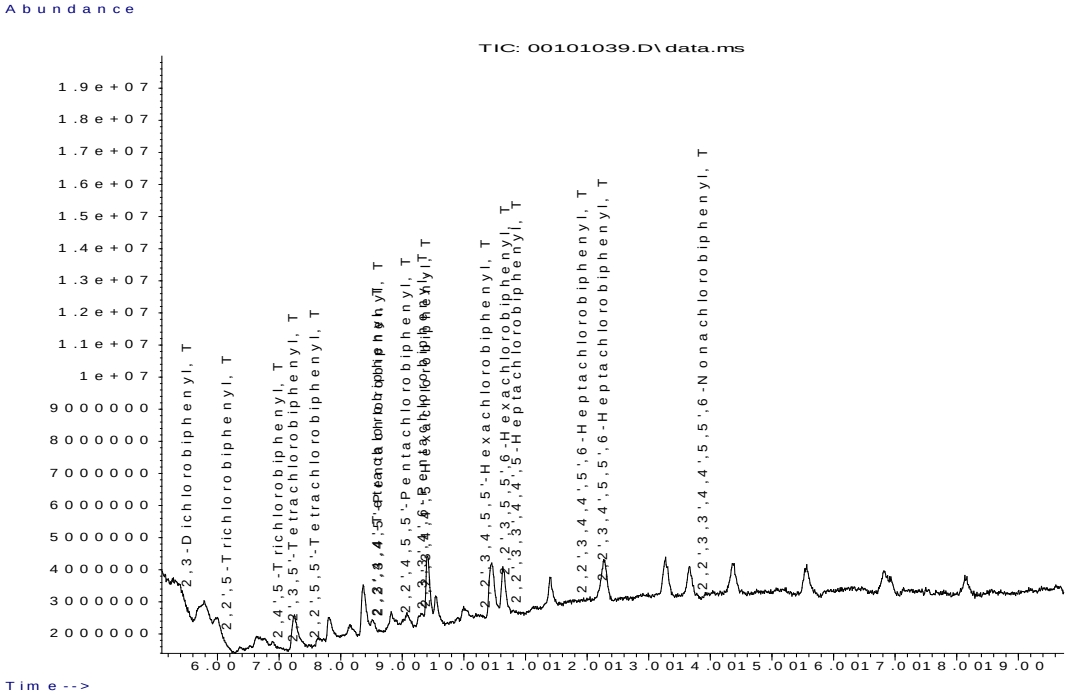

Figure 7: PCBs Composition of Sample Sb3

PCBs Composition of Sample Sb4

Figure 8 indicated the peaks obtained per components present in sample Sb4 soil, while Table 4 clearly illustrated the presence of seventeen polychlorinated biphenyls. The result obtained showed compositions of PCBs in decreasing order whereby 2,2,3,4,4,5,6-Heptachlorobiphenyl revealed highest composition = 0.12 ppm > 2,2,3,4,5,5,6-Heptachlorobiphenyl = 0.10 ppm > 2,4,5-Trichlorobiphenyl = 0.04 ppm > 2,2,3,3,4,4,5-Heptachlorobiphenyl = 0.02 ppm > 2,2,5-Trichlorobiphenyl = 0.02 ppm > . The other five eight components of the soil that showed the same value are; 2,2,3,5,5,6-Hexachlorobiphenyl = 0.01 ppm > 2,2,3,4,5,5-Hexachlobiphenyl = 0.01 ppm, 2,2,3,4,4,5-Hexachlorbiphenyl = 0.01 ppm, 2,3,3,4,6-Pentachlorobiphenyl = 0.01 ppm, 2,2,4,5,5-Pentachlorobiphenyl = 0.01 ppm, 2,3,4,4-Tetrachlorobiphenyl = 0.01 ppm, 2,2,5,5-Tetrachlorobiphenyl = 0.01 ppm. 2, 2, 3, 5-Tetrachlorobiphenyl showed 0.01 ppm.

Other PCBs of Sb4 soil sample with least values in the same sequence are 2,2,3,3,4,4,5,5,6-nonachlorobiphenyl = 0.00 ppm, 2,2,3,4,5-Pentachlobiphenyl = 0.00 ppm, 2,3-Dichlorobiphenyl = 0.00 ppm, 2-Chlorobiphenyl = 0.00 ppm respectively. The result obtained showed that all PCBs composition investigated in Sb4 soil ranged from 0.00 ppm to 0.12 ppm which contradicted the PCBs soil compositions ranged from 0.36ng/g to 2.44ng/g as investigated by Lu *et al*., (2017). The result obtained also contradicted the values of PCBs ranged from 82.0 ng/g (4.8 ng/g), to (18.7 ng/g). as reported by Oluwatoyin *et al*., (2014).

Table 4: PCBs of Sb4

Compound	R.T.	QIon	Response	Conc	Units	Dev(Min)	Qvalue
Target Compounds							
1) 2-Chlorobiphenyl	0.000		0	N.D.			
2) 2,3-	5.439	222	120	0.00	ppm	#	1
3) 2,2',5-	6.126	186	430	0.02	ppm	#	6
4) 2,4',5-	6.975	256	465	0.04	ppm	#	1
5) 2,2',3,5'-	7.482	292	171	0.01	ppm	#	1
6) 2,2',5,5'-	7.482	292	171	0.01	ppm	#	1
7) 2,3',4,4'-	8.614	292	104	0.01	ppm	#	1
8) 2,2',3,4,5'-	8.906	326	117	0.00	ppm	#	1
9) 2,2',4,5,5'-	9.043	326	138	0.01	ppm	#	1
10) 2,3,3',4',6-	9.181	326	369	0.01	ppm	#	1
11) 2,2',3,4,4',5-	9.327	360	160	0.01	ppm	#	1
12) 2,2',3,4,5,5'-	10.374	360	213	0.01	ppm	#	1
13) 2,2',3,5,5',6-	10.537	360	469	0.01	ppm	#	1
14) 2,2',3,3',4,4',5-	10.794	394	687	0.02	ppm	#	1
15) 2,2',3,4,4',5',6-	11.918	396	2613	0.12	ppm	#	1
16) 2,2',3,4',5,5',6-	12.141	394	1992	0.10	ppm	#	66
17) 2,2',3,3',4,4',5,5',6-	13.875	464	90	0.00	ppm	#	1

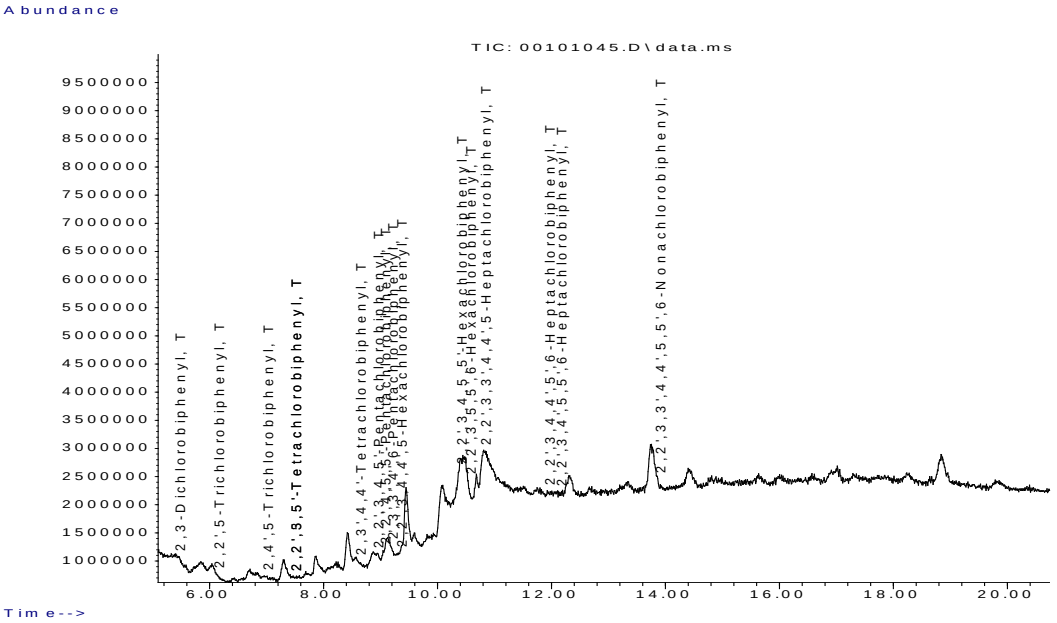

Figure 8: PCBs Composition of Sample Sb4

Comparative Concentrations of PCBs Composition of All Samples

The result obtained showed that 2,2,3,4,4,5,6-Heptachlorobiphenyl in sample in Sb3 has revealed highest composition of 0.25 ppm while 2-Chlorobiphenyl in all samples Showed the least composition of 0.00 ppm composition. The result obtained was contradicted the PCBs values ranged from 0.00414 ppm to 0.000139 ppm as investigated by the findings of Usman *et al.*, (2021).

CONCLUSION

The PCBs pesticides residue composition of four different soil samples from selected area of Dadin kowa Dam Basin were agricultural activities are the dominant occupation of inhabitants of the area. Physicochemical parameters such as pH of soil samples was analysed showed pH values ranged from 7.54 in Sb3 to 7.21 in Sb2 indicated that the soil quality was favourable for cultivation of cereals and vegetables. Conductivity of soil sample investigated ranged from 337.25 μScm^{-1} in Sb4 to 178 μScm^{-1} in Sb3 confirmed suitability of agricultural practices.

Additionally, the soil texture analysis investigated on soil sample Sb1 revealed the highest percentage of sand with 44.44% while soil sample Sb2 has highest percentage of silt soil with 40.90% and soil sample Sb4 has highest percentage of clay soil with 41.66%. Similarly, the PCBs composition of soil samples was determined. The result obtained showed that 2,2,3,4,4,5,6-Heptachlorobiphenyl in sample Sb3 revealed the highest composition with a retention time of 11.875 minutes = 0.25 ppm concentration while 2-Chlorobiphenyl in all samples Showed the least composition with retention time 0.00 minutes = 0.00 ppm concentration.

The results obtained showed that soil samples from Dadin kowa Dam Basin were exposed to threats of pesticides residues contaminations due to their moderate concentrations that ranged from 0.25 ppm to 0.00 ppm compared to standard permissible values of 0.1 to 0.6 ppm. The result obtained contradicted the findings of Modibbo *et al*., (2024) who's PCBs in sediments concentrations ranged from 0.00023 ppm to 0.00253 ppm. Also the result obtained contradicted PCBs values ranged 4.7 ng/g to 91 ng/g as stated by Igor *et al.*, (2014). Hence the application of composite manure, correct neutralize fertilizer will stabilized the soil and also introduction of agricultural extension services by policy makers to educate the local farmers will remedy the impacts of residue contamination of soil consequently improved crop yield.

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