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EXTENT OF LEACHATES INFILTRATION IN A TYPICAL CASSAVA PROCESSING SITE USING INTEGRATED ELECTRICAL RESISTIVITY TECHNIQUES AND ASSOCIATED WATER-LEVEL MEASUREMENT IN APETE SOUTH-WEST NIGERIA

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Abstract

Environmental assessment and subsurface illuminating strength of integrating electrical resistivity method of geophysical investigation techniques comprising 2D Electrical Resistivity Method (ERM) adopting Wenner configuration,

Keywords: CME, Wenner array, impact zone, contaminant seepages, traverses

INTRODUCTION

The effects of leachates or contaminant plumes on the subsurface system most significantly on the aquiferous zones cannot in anyway be overemphasized. Wastes that are generated daily on the earth surface through industrial, agricultural, medical and domestic activities get decomposed and gradually migrate through the porous layers of the earth and find their ways on the subsurface and groundwater system. These waste may contain toxic substances and as they are decomposed or biodegraded, with the presence of infiltrating water and organic liquid effluents known as leachates. Infiltration of rainfall into the landfill together with biochemical and chemical breakdown of the wastes produces leachate which is high in suspended solids and of varying organic and inorganic contents. If the leachate enters surface or groundwater before sufficient dilution occurs,

Vertical Electric Sounding (VES) and water level measurements from four (4) separated hand-dug wells to investigate and evaluate the extent of subsurface leachate infiltration of contamination plume in a cassava processing mill of Apete, South-West Nigeria was conducted in the study area. A total of five (5) 2D profiles (four within the study area while the fifth 40m from the investigated area; being the control site were carried out alongside three (3) VES with a length of 50m each. The electrodes were arranged along a line with a constant spacing between adjacent electrodes. The electrodes were connected to the cable which was connected to the resistivity meter (CAMPUS Ohmega). The minimum electrode spacing used was 10m (for data level n=1) while the maximum electrode spacing used was 50m (for data level n=5). The results showed distinct resistivity zones namely, Leachate plume in topsoil (5-13Ωm), impacted zone (13-120Ωm), and no impact zone (130-550Ωm) in Traverse 1; High impact zone with leachate dominance (10-20Ωm), impacted zone (20-85Ωm), and no impact zone (100-500Ωm), in Traverse 2; Dominant no impact zone (25-120Ωm) with minor leachate intrusion in Traverse 3; No impact zone (20-70Ωm) dominates (90%), minor leachate intrusion (3%), and slightly contaminated area (7%) in Traverse 4 while Leachate present in minor quantity, slightly/partially contaminated zone (13-60Ωm) dominates (85%), and high resistivity zone present in minor quantity was encountered in Traverse 5 with leachates impacting the subsurface to the level of 14m in traverse 2 while the results of VES 1 and VES 2 indicating that the leachates have contaminated the subsurface with indicated low resistivity. The results of the water level measurement obtained from the existing wells indicated a depth of 1.77m in APWW1 (Apete well water) as the lowest depth and 4.60m in APWW4 as the highest depth. The aforementioned results revealed that the soil and shallow groundwater system notably the hand-dug wells within and around the investigated are vulnerable to contaminant seepages emanating from the surface with unprecedented impacts on the study area if no precautionary measures are undertaken.

Serious contamination incidents would transpire (Desa *et* al 2009).

Processing of cassava usually involves grinding and fermentation, which generate large volumes of Cassava Mill Effluents (CME) (Izah e**t** al., 2017). The collection of these cassava mill effluents (CMEs) need to be adequately managed, however, most disposal sites are open, thus creating severe threats to the environments. According to MacDonald *et al*., (2012), leachates are the worst known source of shallow groundwater contamination. Obueh and Odesiri (2016) noted that incessant disposal of CME into the soil changes the microbiological, mineral, and physiochemical compositions of the soil environment surrounding the mills. Leachate plumes generated from cassava effluents can be inorganic chemicals similar to those inorganic contaminations from landfills, open wastes disposal sites, salt brines, and natural salt water intrusions. As observed by Begun *et al*., (2009), large quantities of pollutants have continuously been introduced into ecosystems as a consequence of urbanization and industrial processes.

Solid waste disposal sites frequently create environmental challenges, which also adversely affect the settlers within and around the vicinity of the area. This includes the degradation of the soil and pollution of the surface and groundwater. Leachates from the wastes usually constitute all the materials that exude from household or industrial wastes sites, which contain high concentration of the dissolved or suspended materials. These materials when washed out or leached from the wastes go into solution in water which is a universal solvent. The region of influence and the extent to which these leachates had progressed from the source over time is being considered here as the Leachate Plumes. A good number of health disorders such as anemia, heavy metal poisoning, behavioral and genetic order among others could result from the infiltration of polluted water from improperly disposed waste (Palmer *et al*., 2005; Ogundiran *et al*., 2008). Cyanide can exist in aqueous solution as free cyanide (hydrocyanic acid (HCN) or cyanide ion (CN^-) or in complexes with metals such as cobalt, iron, nickel and others. The toxicity of cyanide to humans and aquatic life is primarily associated with free cyanide. Metal- cyanide complexes, especially strong complexes with cobalt and iron, are much less toxic (Hartung, 1990; and Shifrin *et al*., 1996) than free cyanide and weak acid dissociable complexes with metals like copper, zinc, and nickel. The concentration of cyanide in a typical cassava ranges from 75 to 1000 mg/kg; however, certain varieties have as high as 2600 mg/kg and even greater (Igbozurike *et al*., 2009). Fresh cyanide from cassava mills becomes toxic on exposure to the atmosphere and very mobile. The toxic materials formed from exposure to atmosphere infiltrates and percolates into aquifers with attendant contamination. The degree to which groundwater is contaminated by cassava wastewater is influenced by the vulnerability of aquifers, the quantity of cassava milled per day, the existence of preferential flow paths and subsurface lithostratigraphy beneath the trench or the surficial surface. Contaminants from ground surface are transported into aquifer by flowing groundwater. Groundwater discharge by pumping tends to decrease the distance travel by contaminants and therefore increases the mass of contaminants (Ahmadi *et al*., 2021). Human exposure and the risks generated by cyanide (CN^-) contained in cassava roots, occur mainly through inadequate consumption of cassava, without proper cooking (Abraham *et al*., 2016; Honorato *et al*., 2020; Santos *et al.,* 2021) which can cause several clinical manifestations, from mild to severe, such as headache, nausea, vomiting, dizziness, mental confusion, hypertension, difficulty breathing, cardiovascular problems and loss of consciousness. (Honorato *et al*., 2020; Brazil Ministry of Health, 2015; Brazil Ministry of Health, 2022).

Electrical resistivity techniques is a non-invasive means of delineating contaminant plumes from the point sources because leachates diminish the resistivity of the strata that contains them (Aweto, 2017). The use of 2D electrical resistivity in mapping subsurface lithology, contaminant plume, and hydro geochemical analysis in assessing the physiochemical parameters in the area suspected to be contaminated with organic and inorganic substances have been carried out by numerous researchers. They include (Amidu *et al*., 2006). According to (Abdullahi *et al*., 2011) carried out integrated geophysical surveys involving 2D electrical resistivity. Olayinka *et al*., 2011 have used geophysical resistivity imaging for better understanding of contaminant transport from leachate in a basement complex terrain. The leachate from this cassava processing site has a high ionic content, making it more conductive than the surrounding area (Kearey *et al*., 2002). This makes electrical resistivity a suitable method for investigating and detecting the contamination zones in the study area (Dobrin, 1985; Keary and Brooks, 1991; Keary, 2002; Adagunodo et al., 2018; Adagunodo and Oladejo, 2020).

The primary drawbacks of these VES approaches are the basic sounding interpretation assumption of a horizontally stratified earth model, which conflicts with the local geological model, and the profiling method's inability to map variations in resistivity with depth (Griffiths and Barke, 1993). The use of resistivity imaging method will present detailed information about the delineation of contaminated zones of the area. The electrical resistivity (ER) method was selected to investigate the leachates and their impact on groundwater. These studies have shown that the ER method can effectively detect and map the migration of CME leachates and other associated contaminants from a cassava processing sites. Omolayo and Tope (2014) examined the generation, migration and impact of the leachate plume on groundwater and soil at Ibadan, Southwestern Nigeria using 2D electrical Imaging and element analysis, WHO standard, hence pose health risk to the inhabitants. The study was carried out to ascertain delineate the level and extent of leachate contamination derived from infiltration from cassava products

STUDY AREA

Location and Accessibility

The study area is Apete and its environs in Ido Local Government, Oyo state, South-Western geopolitical enclave of Nigeria. It is geographically located between latitude 7°27´02´´N -7°27´03´´N and longitude 3°52´11´´E and 3°52´13´´E respectively as shown in Figure 1.1. It is positioned approximately 0.73km west of Apete motor Garage and about 1.7 km south of Ibadan Polytechnic. It is accessible through major roads and footpaths. Two prominent landmarks in the vicinity of the study area include Cardinal Special Hospital and the PHCN power station (Dare and Fatoba, 2018; Oladunjoye et al., 2014; Akinbiyi et al., 2018).

Relief and Drainage

Apete lies mostly on lowlands which are punctuated by rocky outcrops and series of hills. Three major landforms of hills, plains and river valleys dominate the whole landscape of the region. The metropolis is drained by three important rivers, river Ogunpa, river Ona, and river Ogbere and their several tributaries including Omi, Kudeti, Alaro and Alapata. This combination of hills and river valleys provide a good drainage for the city but it has suffered a lot of abuse due to blockages of the water courses by solid wastes coupled with construction of structures along the river courses and sometimes within the river course itself (Dare and Fatoba, 2018).

Climate and Vegetation

The study locations have the tropical wet and dry climate as it falls in the transition zone between the rain forest and the savannah. The region experiences a fairly high uniform temperature, moderate to heavy seasonal rainfall. The mean annual temperature is about 26.20°C and the annual rainfall of 1200mm. The relative humidity is within the range 75-95%. Apete lies in transition zone forest of Ibadan Geographical region and the Northern savannah region (Dare and Fatoba, 2018; Oladunjoye et al., 2014; Akinbiyi et al., 2018).

Geology of the Study Area

It falls within the Precambrian rocks of Southwestern Nigeria. The major rock types are the schist-quartzites, granite-gneiss, banded gneiss and migmatites where banded gneiss is predominant characterized by a layering appearance due to the differentiation of light and dark mineral assemblages. (Jones and Hockey, 1964), while minor rock types such as pegmatite, aplites, quartz veins, and dolerite dykes intruded the main rocks in places. Close observations of the rock types revealed coarse grained and the banding is distinctly foliated (Akinbiyi et al., 2018). The quartzite found in the area occurring in ridge pattern is arenaceous rocks that have been metamorphosed exhibiting cracks and joints features. Gneisses are migmatized in places, and characterized by predominantly medium-sized grains while the schist-quartzites occur as elongated ridges striking NW-SE (Olayinka *et al*., 1999). The study area is typified by banded and migmatite gneisses which generally strike NW-SE and dip to the east (Figure 2). The elevation of the encountered outcrops within the study area ranged from 209m to 212m comprising of linear structures cum pervasive fractures with the intrusions of quartz veins (Akinbiyi et al., 2018). Figure 2 reveals the location of the study area as represented in generalized geological map of Ibadan. The joints on the outcrops in the area are mostly oriented perpendicular to the strike (NW-SE) of the rock foliation. Notable N-S and NW-SE plunging minor fields were mapped on the gneiss complex. The area is naturally drained by four rivers with many tributaries: the Ona river in the North and West; the Ogbere river towards the East with Ogunpa River flowing through the area and the central part of the metropolis; being a third-order stream with a channel length of 12.76km and a catchment area of 54.92km² (Dare and Fatoba, 2018; Oladunjoye et al., 2014; Akinbiyi et al., 2018).

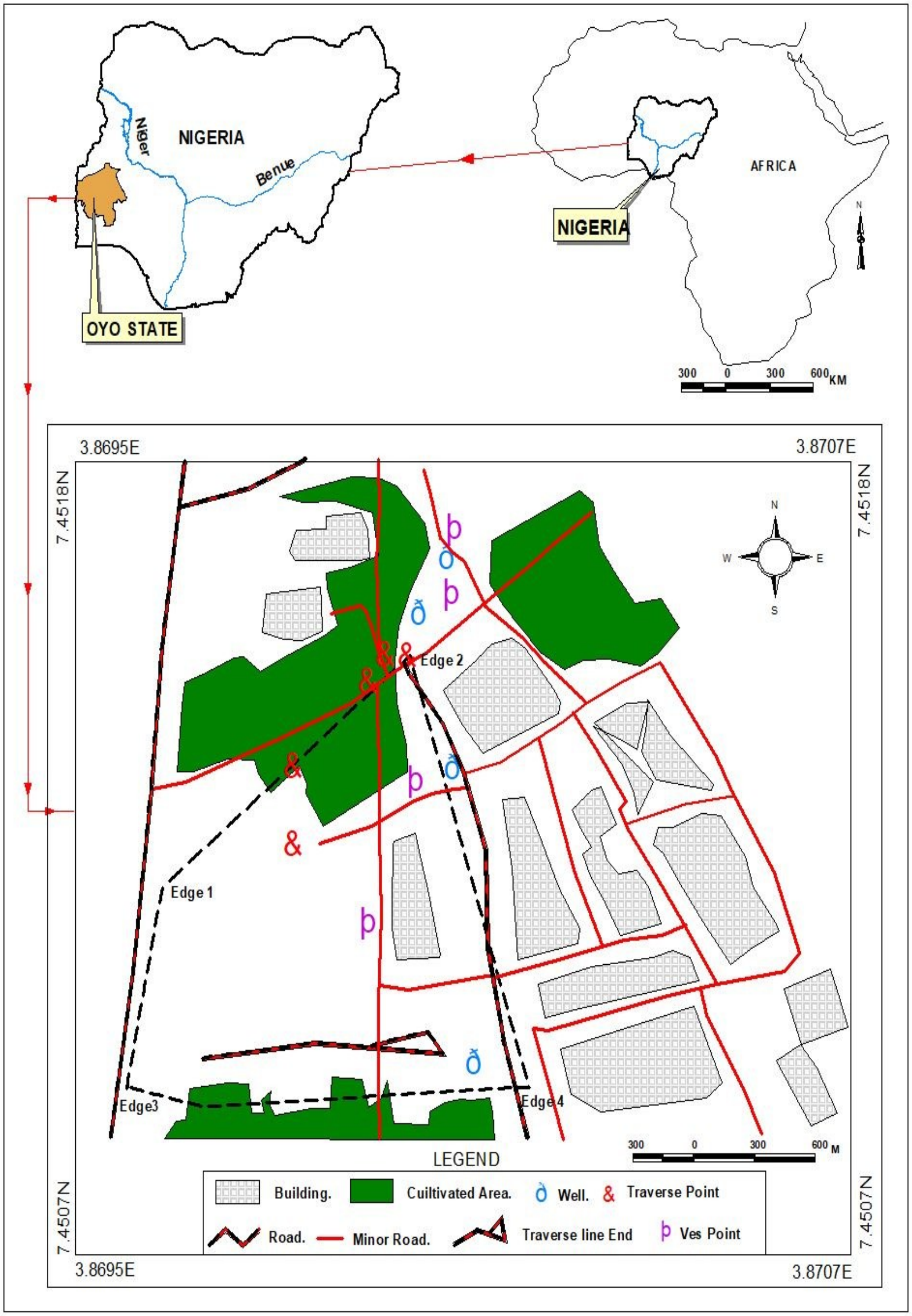


Figure 1: Geographical and Data Acquisition Map of the Investigated Area

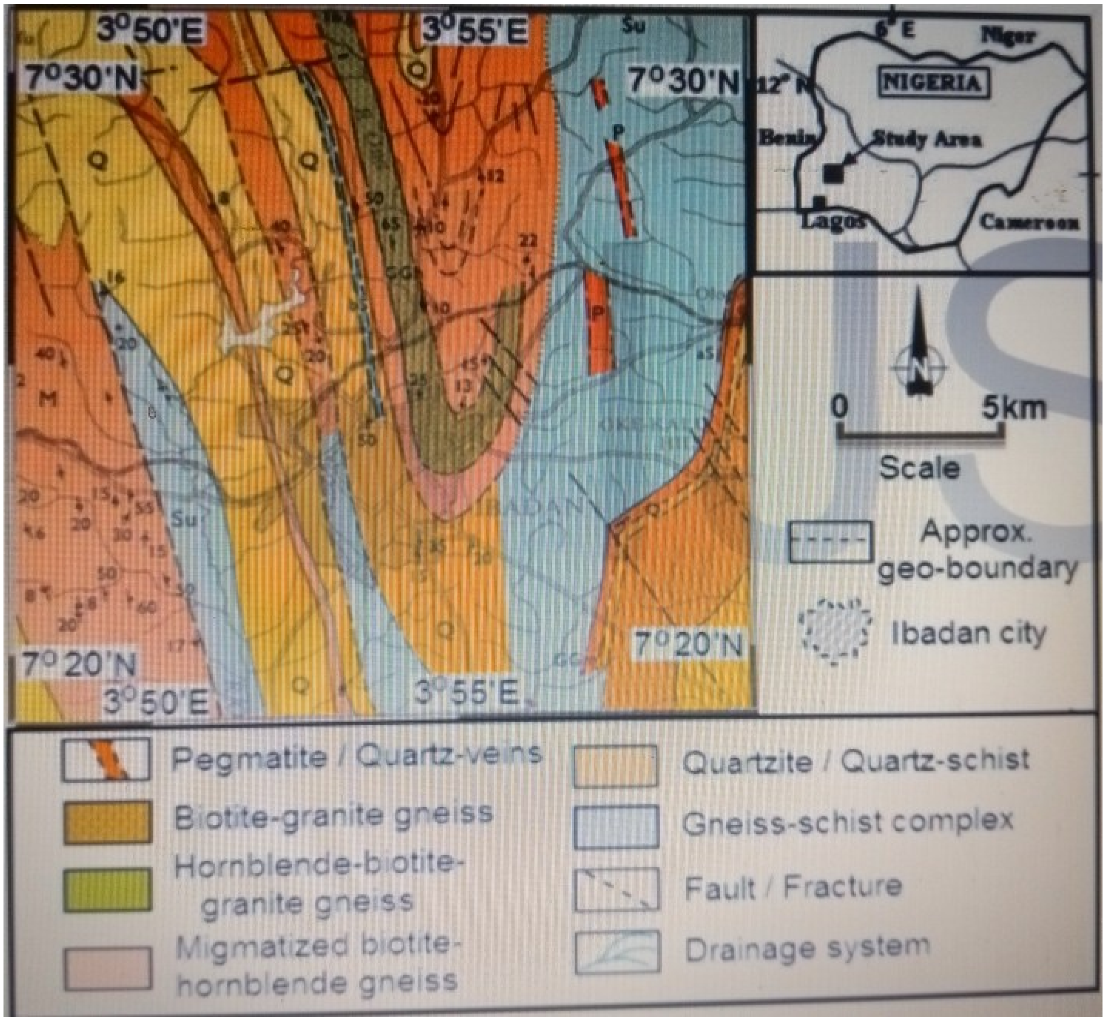


Figure 2: Geology map of the study area (Akinbiyi et al., 2018)

MATERIALS AND METHODS

Field Operations for 2D Electrical Resistivity Tomography

The electrical resistivity method was employed at Apete to investigate the migration of leachates in soil and their impact on the surrounding water environment. A total of (5) 2D profile was done with a length of 50m each (Figure 3). The electrodes were arranged along a line with a constant spacing between adjacent electrodes. The electrodes were connected to the cable which was connected to the resistivity meter. The minimum electrode spacing used was 10m (for data level n=1) while the maximum electrode spacing used was 50m (for data level n=5). A 50m traverse was measured with rods spaced 2m apart in each of the traverses. At each rod point, the current and potential electrodes were connected and inserted into the ground. Successive points were spaced 1m apart, increasing the depth of investigation. The acquired electrical resistivity data was processed using the DIPRO software (Loke, 2004).

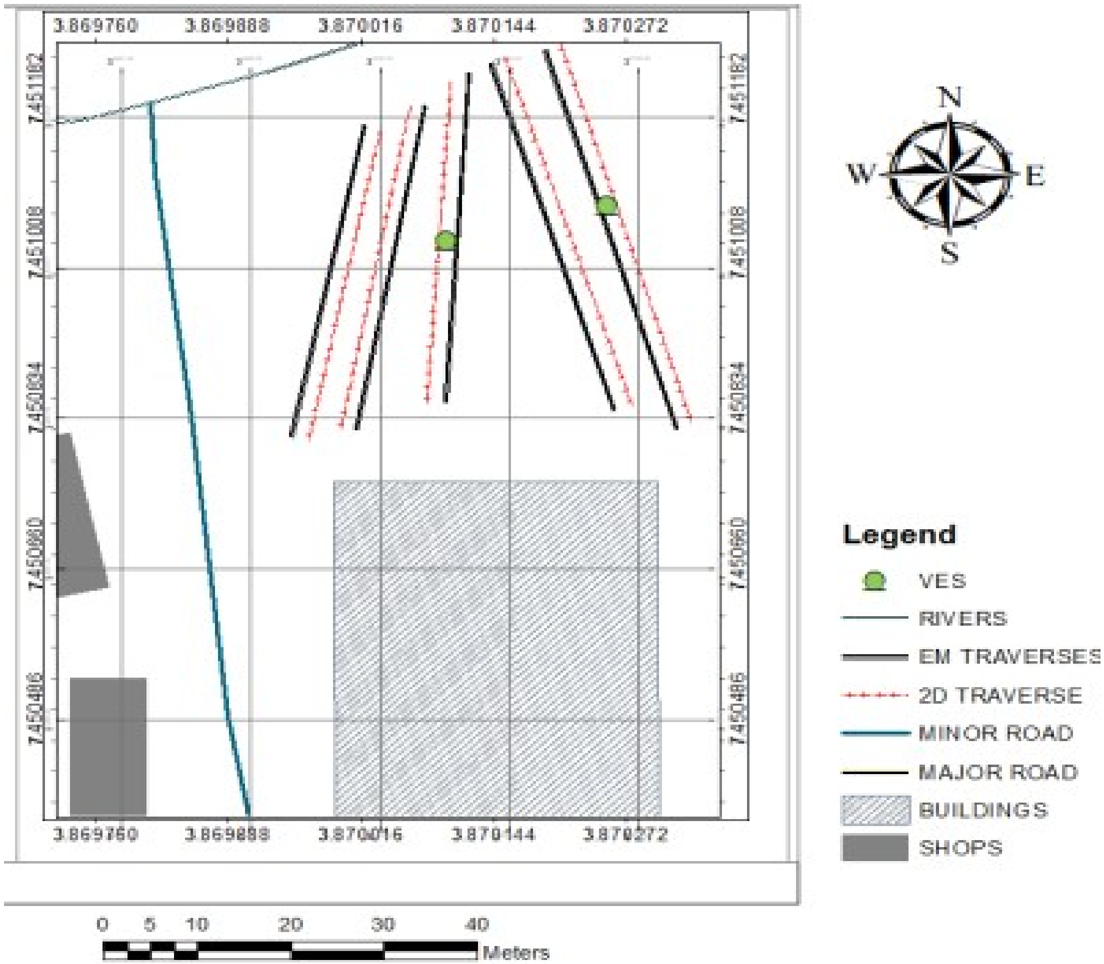


Figure 3: Location and Outline Map of the Investigated Area

Elevation corrections were not carried out because the survey area was fairly flat. The data was first filtered to remove the bad data points whose resistivity values were clearly wrong compared to the neighboring data points. Least-squares inversion was then carried out on the resistivity data using the DIPRO software in order to generate the 2D inverse resistivity models, electromagnetic method, and seismic method. Sometimes, one or two of these methods are used as a reconnaissance survey. Electrical resistivity method (ERI) was employed during the course of this study. The ERI involved physical parameters which include the resistivity, geoelectrical parameters etc. The major advantage of the electrical resistivity tomography survey is that it takes care of the limitation of the vertical electrical sounding survey by taking into consideration horizontal changes as well as the vertical changes in the layer resistivity as the resistivity changes in both directions along the survey line (Loke, 2000). So, it is therefore, a more accurate model of the subsurface investigation (Loke, 2004). A resistivity meter (usually 4-6) and cables were used. The CAMPUS Ohmega resistivity meter was utilized in data acquisition. Electrodes were placed in a linear array, typically total spread length of 70m. The current was injected into the ground through the outer electrodes (C1 and C2). Then the potential differences between the inner electrodes (P1 and P2). Voltage and current values for each electrode separation was recorded. Typically, data is collected for multiple electrodes spacing to probe different depths.

Data Processing and Interpretation

The data collected was loaded into processing software (Terameter). Filters were applied to remove noise and outliers, ensuring a smooth and reliable dataset. Apply corrections for electrode spacing, terrain effects and instrument errors. Refine the model by adjusting parameters and iterating the inversion process to achieve a better fit between the measured and modeled data. The data from the ERT survey was interpreted was interpreted using DIFROFWIN. The extent and the distribution of subsurface features such as the contaminant plumes was mapped

The Data were interpreted using partial curve matching and computer iteration programme using WINRESIST.

RESULTS AND DISCUSSION

The interpretation of the field resistivity data were done in terms of variation in the resistivity with depth to the bedrock and lateral variation.

2D Electrical Resistivity Tomography in Apete

Interpretation of 2D-Traverse 01

The resistivity structure (Figure 4) reveals extent of leachate migration in the soil such that at the first zone (blue color) which is a very low resistivity zone with resistivity ranging from 5-13Ωm. This zone is intruded by leachate plume which impacted the soil. It starts from the surface to depth ranging between 3-6m at the western view of the profile. It thickness ranges from 3-8.5m on the observed apparent resistivity data. This zone is the top soil in which it is lateric sand and clay. The low resistivity ends of this spectrum indicate the real contaminant leachate plume. Leachate is only present in the structure in a very low quantity thereby lacking dominance of leachate. Zone 2 (green color) is the next zone underlying the leachate zone. It is the zone of moderately low resistivity values ranging between 13-120Ωm. The resistivity value range is a little bit higher than the resistivity of the first zone. Hence, it is assumed that this zone had been impacted by the migrating leachate. The zone is classified as impacted zone. Third zone is the zone with resistivity ranging from 130-550Ωm with depth ranging from surface to 7-15m in the western path of the profile. It has very high resistivity (yellow/red/purple) compared to other zone because it's free from contamination especially (red/purple colour). This zone is found in the western portion, middle region and also the eastern portion of the profile Figure especially the higher resistivity value. The zone is classified as no impact zone.

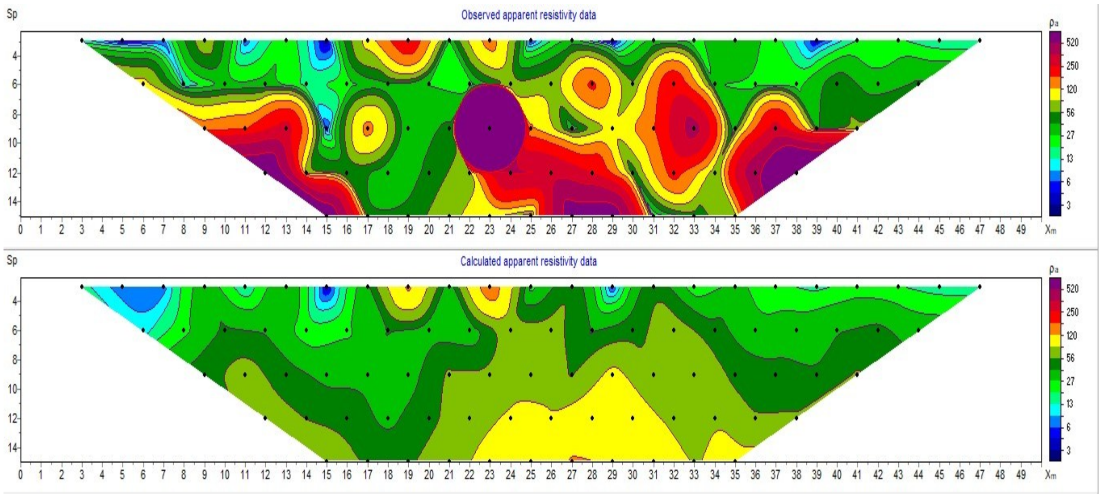


Figure 4: 2D Resistivity Imaging of traverse 01

Interpretation of 2D-Traverse 02

The resistivity structure (Figure 5) reveals extent of leachate migration in the soil such that at the first zone (blue color) which is a very low resistivity zone with resistivity ranging from 10-20Ωm. leachates is in larger proportion dominating the upper half of the profile unlike traverse 01. This zone is interpreted to be the dumped waste and the generated leachate plume has impacted the soil. It starts from the surface to depth about 14m at the middle region view of the profile. . This zone is the top soil in which it is lateritic sand or clay. The low resistivity end of this spectrum indicates the real contaminant leachate plume. The leachate zone is concentrated and positioned across from west to east of the profile. This zone is classified as high impact zone. Zone 2 (green color) is the next zone underlying the leachate zone. It is the zone of moderately low resistivity values ranging between 20-85Ωm. The resistivity value range is a little bit higher than the resistivity of the first zone. Hence, it is assumed that this zone had been impacted by the migrating leachate. It started from the surface to the last depth on the eastern margin of the profile below. The thickness ranges across the profile and it's the most dominating zone in this particular profile constituting up to 65-70% of the profile. The zone is classified as impacted zone. Third zone is the zone with resistivity ranging from 100-500Ωm with depth ranging from around 9m to15m in the western path of the profile. It has very high resistivity (yellow/red/purple) compared to other zone because it's free from contamination especially (red/purple colour). This zone is found in the western portion of the profile especially the higher resistivity value. The zone is classified as no impact zone.

Interpretation of 2D-Traverse 03

This profile (Figure 6) reveals the dominance of the high resistivity zone which ranges around the profile. Only minor amounts of leachate are found intruding the profile. The dominating zone (red/purple color) is said to be free from contamination with resistivity ranging from around 25-120Ωm but majorly dominating the downward zone of the profile. The slightly contaminated zone is also available in a minor proportion but around the upper region with its low resistivity. Most of the region in this profile are unaffected and can be said to be a no impact zone because migrating plume haven't reach majority of the region thereby holding a high resistivity threshold.

Interpretation of 2D-Traverse 04

From the surface to the last depth of around 15m is a zone with high resistivity that's totally free from contamination with resistivity ranging from 20-70Ωm (Figure 7). It dominates around 90% of the entire profile with thickness ranging from 6-47m across the entire profile. Leachate only intruded like 3% of the entire profile, thereby having no impact. The slightly contaminated area is also in a very minor quantity like 7% of the profile.

This particular profile can be said to be the profile that's least affected by the migrating plume with only a minor trace of leachate and around 90% of the entire profile isn't contaminated or affected.

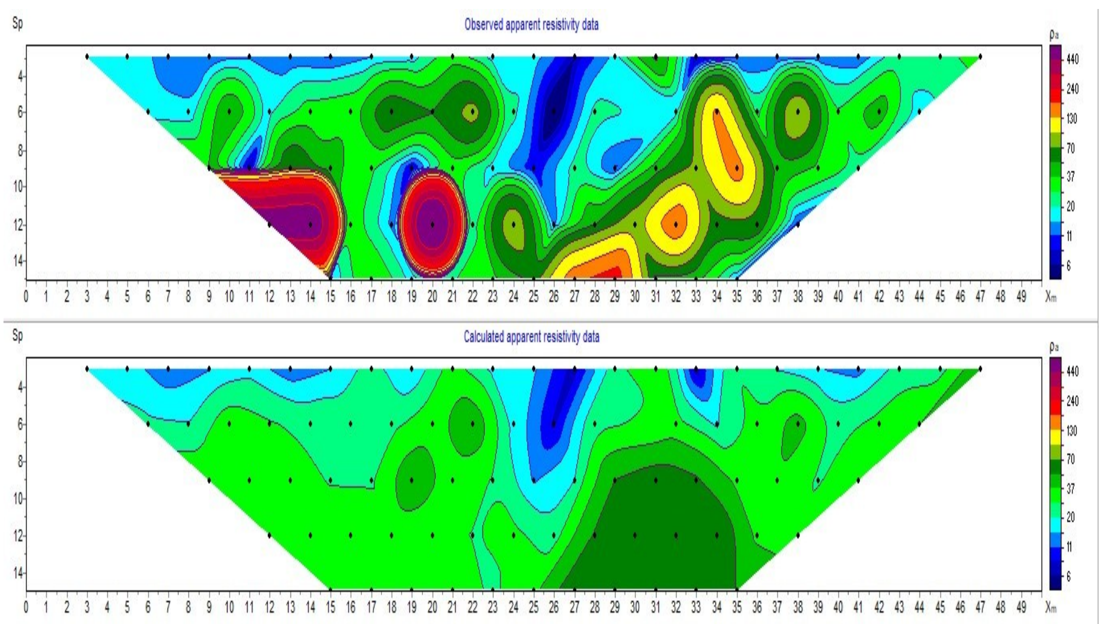


Figure 5: 2D Resistivity Image for Traverse 02

Interpretation of 2D-Traverse 05

Leachate can be found present in the profile in minor quantity although in scattered identity (Figure 8). Around 85% of the entire profile is a zone which is slightly/ partially contaminated in which the migrating plume is yet to reach. It has low resistivity with resistivity ranging from 13-60Ωm. it spreads across from western region to eastern region dominating the entire profile.

The high resistivity zone (red/purple color) is only seen in the profile in a small quantity ranging from 9-15m depth around the western margin. It's a zone which is totally free from contamina-tion but just available in minor dominance.

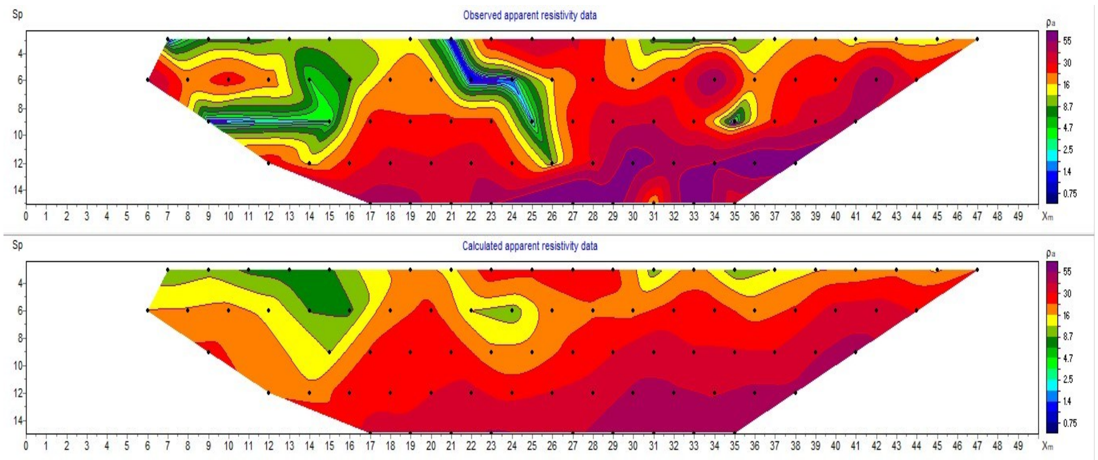


Figure 6: 2D Resistivity Imaging of Traverse 03

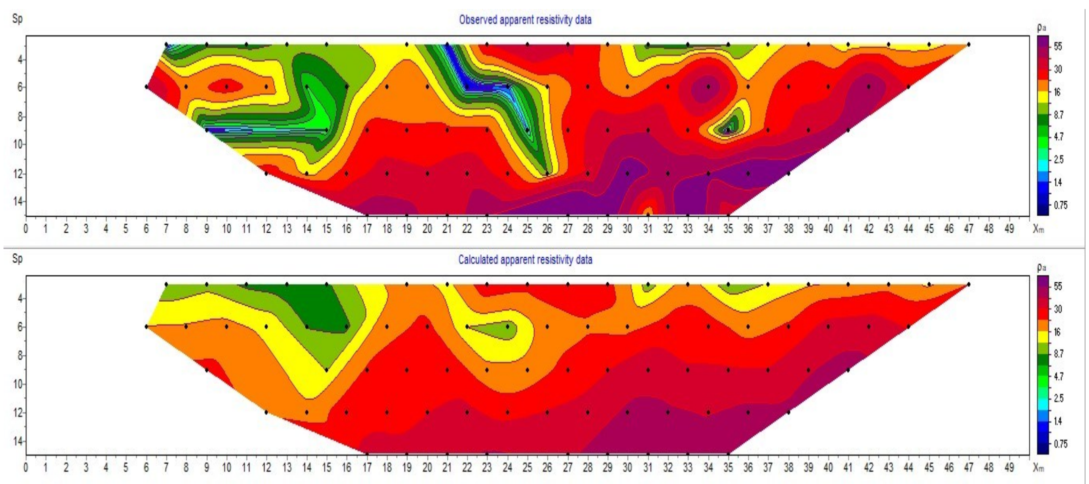


Figure 7: 2D Resistivity Imaging for Traverse 04

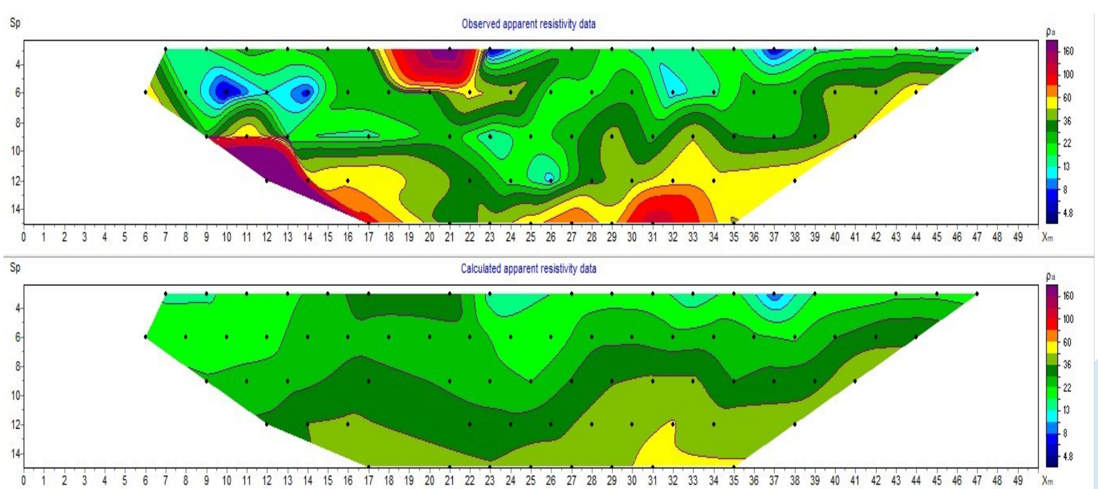


Figure 8: 2D Resistivity Imaging for Traverse 5

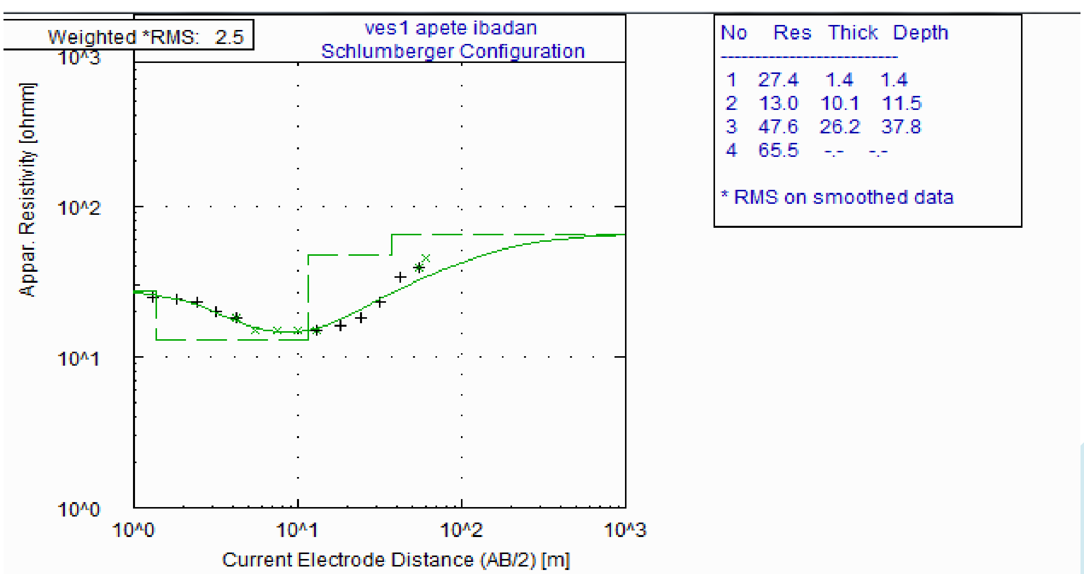
Vertical Electric Sounding (VES) in Apete

After applying the computer iteration program and the curve matching techniques, the results reveal the presence of four geolectric layers. The first layer is the top soil. The second and the third layer are the weathered layers while the last layer is the fresh basement. The fresh basement is characterized by high resistivity value.

VES 1 has a characteristic curve of H (Figure 9) which reveals four (4) geoelectric layers (Table 1). The first layer has a resistivity value 27.4Ωm with a thickness value of 1.4m and a depth of 1.4m which is identified as Top soil. The second layer has a resistivity value of 13.0Ωm with a thickness of 10.1m and a depth of 11.5m which is a clay layer. The third layer has a resistivity of 47.6Ωm with a thickness of 26.2 and a depth of 37.8m which is a sandy layer. The last layer has a resistivity value of 65.5Ωmis identified as Fresh basement.

VES 2 has a characteristic curve of H which shows four (4) geoelectric layers (Figure 10). The first layer has a resistivity value 82.6Ωm with a thickness of 0.8m and a depth of 0.8m which is identified as Top soil. The second layer has a resistivity value of 18.0Ωm with a thickness of 5.6m and a depth of 6.4m which is a clay layer. The third layer has a resistivity value of 101.4Ωm with a thickness of 5.6m and a depth of 6.4m which is a sandy layer. The last layer has a resistivity value of 104.6Ωm which is identified as Fresh basement.

VES 3 has a characteristic curve of A which reveal four (4) geoelectric layer (Figure 11). The first layer has a resistivity value of 103.8Ωm with thickness of 2.0m and a depth of 2.0m which is identified as Top soil. The second layer has a resistivity value of 198.4Ωm with a thickness of 19.2m and a depth of 21.2m which is a Clay layer. The third layer has a resistivity value of 233.1Ωm with a thickness of 28.9m and a depth of 50.0m which is a Sandy layer. The last layer has a resistivity value of 340.9Ωm which is identified as a Fresh basement.



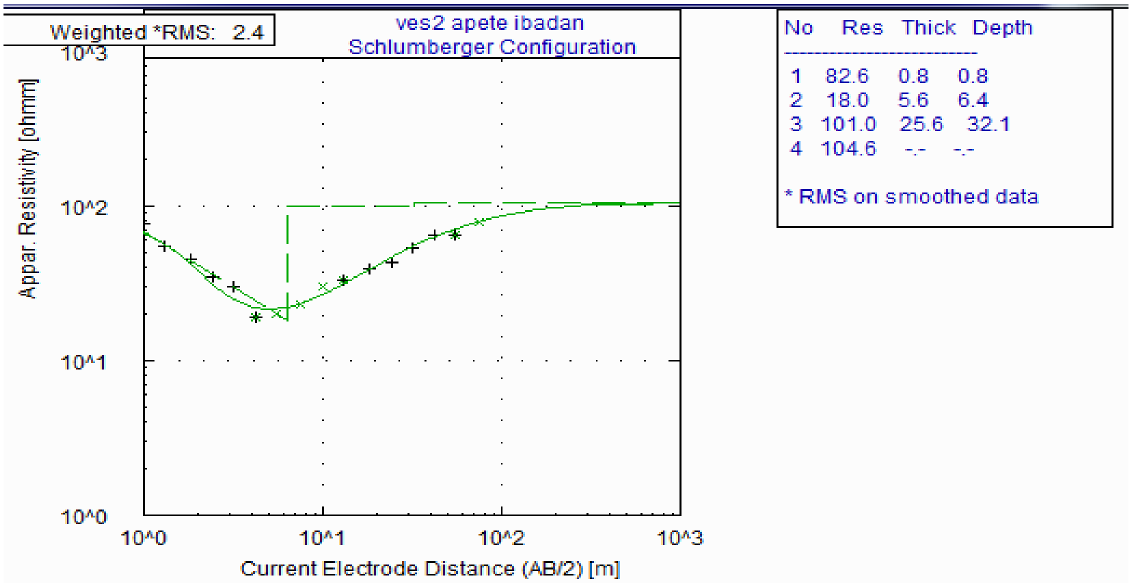


Figure 9: Typical H-type iterated VES curve in the study area.

Figure 10: Typical H-type iterated VES curve in the study area

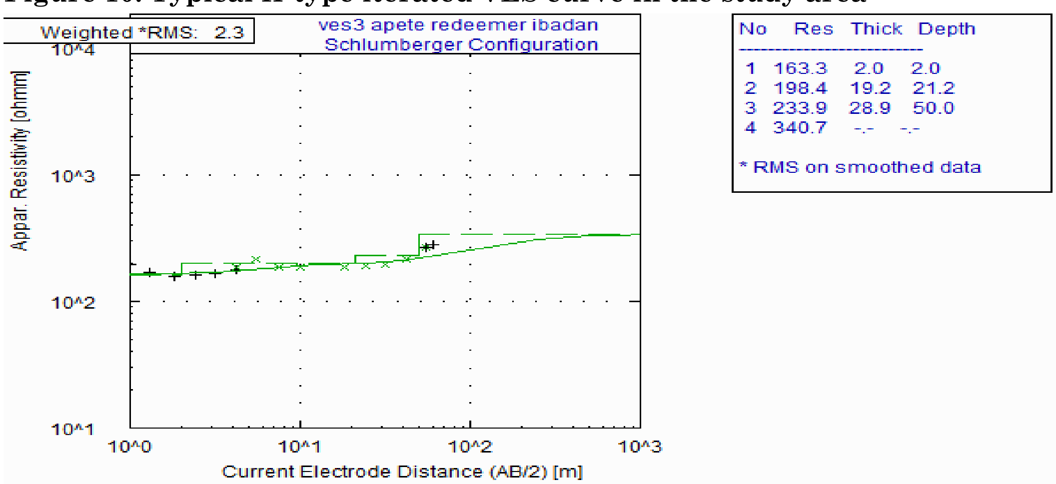


Figure 11: Typical A-type iterated VES curve in the study area

Table 1: Quantitative Interpretation of VES curves

	Layer	Resistivity(Ωm)	Thickness (m)	Depth	Lithology Sequences
Apete VES 1	1	27.4	1.4	1.4	Top soil
	2	13.0	10.I	11.5	Contaminated zone
	3	47.6	26.2	37.8	Partly low/ weathered/
	4	65.5	-	-	Weathered/ partly
Apete VES 2	1	82.6	0.8	0.8	Top material
	2	18.0	5.6	6.4	Contaminated/ sandy clay
	3	101.4	25.6	32.1	Weathered layer
	4	104.6	-	-	Fractured/partly fresh
Apete control VES	1	103.8	2.0	2.0	Top lateritic
	2	198.4	19.2	21.2	Clayey sand
	3	233.1	28.9	50.0	Fractured
	4	340.9	-	-	Fresh basement

The Electrical Resistivity imaging results from VES 1 and 2 indicate that the leachate has infiltrated the subsurface area and they were characterized by low resistivity. This suggests that the layers has been contaminated; in contrast to VES 3 which serve as a control site which exhibits high resistivity and low conductivity indicating that the leachate has not migrated to this area, making it relatively free from contamination. Table 2 is the result obtained from the measurement of well parameters from the existing wells while figure 12 shows the variation of water levels and well depth with respect to each location in the study area indicating a depth of 1.77m in APWW1 (Apete well water) as the lowest depth and 4.60m in APWW4 as the highest depth. The well head ranged from 0.36 in APWW1 to 0.71m in APWW4

Table 2: Water Level Measurement

Well code	Latitude	Longitude	Elevation	Well Head	Water Level	Water Depth	WPD	CMED
APWW1	7.451111	3.870278	190m	0.36m	3.34m	3.78m	43m from APWW2	15m from traverse 01
APWW2	7.451389	3.870278	190m	0.5m	0.84m	1.77m	35m from APWW3	21m from traverse 02
APWW3	7.451667	3.870556	190m	0.5m	3.27m	3.91m	49m from APWW4	35m from traverse 03
APWW4	7.450833	3.870278	190m	0.71	3.97m	4.60m	52m from APWW5	27m from Traverse 04
APWW5	7.450701	3.870119	190m	0.5m	3.30m	4.22m	49m from APWW4	traverse 05

Key

APWW= Apete Well Water

W.P.D = Well Proximity Distance

CMED = Cassava Mill Effluent Distance from the Investigated 2D traverses

Figure 12: Variation of Water level and Well depth with Locations in the study Area

CONCLUSION

Electrical geophysical survey utilizing the integration of five (5) 2D electrical resistivity profiles and three (3) VES profiles adopting wenner configuration was used to delineate the extent of leachate infiltration on a typical cassava processing site in Apete Southwestern Nigeria. This study was undertaken to investigate the impact of effluents on the subsoil and groundwater environment. The acquired apparent resistivity data and corresponding ERT images were interpreted using the DIPROWIN software. From the quantitative interpretation of the pseudo section, the top soil layer was indicated which is the clay in all traverses. The results showed varying degrees of leachate contamination with High impact zones (blue color) with a resistivity of (5-20 0hms meter) indicated significant leachate contamination. Impacted zone (green color) with moderately low resistivity (13-120 ohms meter) showed some leachate migration. No impact zones (yellow/red/purple color) with high resistivity (130-550 ohms meter) were free from contamination. The pseudo-sections show that the leachate has contaminated the top soil. The 2D interpretation indicates that the study area is underlain by the top soil which is the clay. The resistivity of the top soil varies from 5-20 ohms meter. The results of the 2D show that the top soil has a relatively low resistivity and lowthickness and it is the most contaminant zone. 2D survey was employed in this study and 2D profiling delineates the lateral distribution and vertical extent of the leachate contaminant plume and subsequently gives an image of the subsurface The VES 1 and 2 showed that the leachate has contaminated the subsurface indicated by low resistivity and high conductivity with varying depths. It was observed that the 2D imaging gives better results than VES because it gives an image of the subsurface laterally and vertically. The results revealed that the surrounding soil and the groundwater within and around the cassava processing site have actually migrated into the aquifer system, thereby contaminating to depth of 14m in Traverse 02.The electrical resistivity imaging survey has successfully identified areas of subsurface contamination caused by the leachate migration from the site. The results indicate that VES1 and VES2 are contaminated while VES 3 is relatively free from contamination due to a natural barrier; the VES 3 has no contamination with high resistivity and low conductivity, due to the fact that the leachates have not migrated at the area and it is sited far from the source of the leachates.

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