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Research Article

Impact of Cassava Processing Mill Effluent on Physical and Chemical Properties of Soil in Akure, Ondo State, Nigeria

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ABSTRACT

The research aims reviewed impact of the Cassava Processing Mill Effluent (CME) on the physco-chemical properties of soils. Collected samples of three chosen areas at the Igbatoro community, Akure, Ondo State, Nigeria and labeled as A B C. Soil samples free from cassava mill effluent were likewise gathered from two unique areas marked D and E to serve as control samples at an interval of 15 cm depth from the top. Chemical changes occurred in the soil because of the release of effluent from cassava handling plants; the soil samples collected were analyzed in the laboratory utilizing the Atomic Absorption Spectrometry (AAS) method. The accompanying physical and chemical parameters were investigated; soil texture, soil porosity, particle size, TOC, pH, electrical conductivity, Pb, Zn, Cr, Fe, K, Ca, and Na. Results were compared with the result obtained from the control site Federal Environmental Protection Agency (FEPA) and World Health Organization (WHO) standards. Analysis shows that the soil samples with CME exceeds the WHO and FEPA standards. The result shows that the CME has contaminated the soil and made it unsatisfactory for agricultural purposes; this also affected the environment and the soil organic matter. Based on WHO and FEPA standard regulations, these metals exhibit hazardous concentrations. There was no huge expansion in Pb and Cr grouping of CME samples with the control tests. The chemical concentration of CME and its consequences for the soil propose its true capacity as a bio fertilizer particularly for K and Na contents. Findings shows that the effluent has great effect on the surrounding soil, and which leads to soil pollution, remediation should be practice.

RESEARCH ARTICLE

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INTRODUCTION

Nigeria is the biggest cassava delivering country on the world and is no less than multiple times more than that of Brazil and has now multiplied the creation of Indonesia and Thailand (Odubanjo *et al*., 2011; Obayelu *et al*., 2022). Nigeria cassava creation has been growing beginning around 1960 when the country gain independence from Great Britain. The following cassava production figures were recorded for Nigeria, which shows an upward trajectory between TE1970 – TE2018 as 9.3 million tonnes (1970) to 59.5 million tonnes (2018) as indicated by *Ikuemonisan et al.* (2020). Consequently, in Nigeria and in most tropical nations, cassava has been the staple food and with the continuous improvement in the works, it is progressively changing from a starvation hold item and normal staple food to cash crop for metropolitan use and to an item thing for business sector. Today, cassava is the basic wellspring of dietary food energy for the vast majority living in the bog jungles, and a huge piece of the sub-moist jungles of West and Central Africa (Tsegia and Kormawa, 2002).

In this piece of the country, cassava tuber is taken care of and prepared for use mostly either as garri, starch, or as dried or wet cassava flour. All significant handling stage is in handling, and these prompts areas of cassava processing machines generally around the environment. Results got during this cycle is called cassava mill effluent (CME) include the solid and liquid waste. The significant limitation in cassava tuber as human food is the presence of toxic cyanogenic glycoside compounds in the tissues. Cassava tissues in like manner contain the catalyst linamarase, which can hydrolyse cyanogenic glycoside anyway the compound isn't arranged in comparative cell compartments as the cyanogenic glycosides (Ogbonna *et al*., 2021). Cyanogenic glycosides are arranged inside vacuoles and the protein linamarase in the cell divider. Cyanogenic glycoside is filtered from vacuole and meet linamarase, a glucosidase, to convey $(CH_3)_2CO$ cyanohydrin from linamarin and 2-butanone cyanohydrin from lotaustralin (Conn, 1994). These cyanohydrins are unsteady and break down sharply to the relating ketones and hydrogen cyanide (HCN) at pH values more than 5 and temperatures above 300°C.

Cassava mill effluent creation has expanded emphatically because of expansion in cassava production. This mill effluent should be appropriately control prior to releasing forestall nitrogen-fixing deficiency microorganisms (Agbo *et al*., 2021). Technical analysis revealed that discharged cassava processing effluent if not control may cause serious harm to the ecosystem (Antia *et al*., 2021). This biowaste is considered a major contributor essentially to natural contamination and consumption of water asset quality because of the high chemical oxygen demand (COD) of liquid waste, high biochemical oxygen demand (BOD) of suspended solids (Plevin and Donnelly, 2004), high cyanide content and unpleasant odor of CME (Adeyemo, 2005). Contamination of those heavy metal played intense general wellbeing worry because of its ingenuity, harmfulness and non-biodegradability in the environment (Smah *et al*., 2021).

It is very important to reduce its environmental impact because if it is not properly managed it will constitute nuisance to both terrestrial and aquatic life and cause a lot of havoc to vegetation's, houses, and bring about infection to microbe and infestation which can lead to environmental hazard. The aim is to evaluate impact of heavy metals levels and chemical attributes from effluent discharge in cassava mill on surrounding soil, in other to proffering solution to its improper disposal, and analyzed environmental hazards associated with cassava mill effluent.

MATERIALS and METHODS

Study area

Igbatoro people group, arranged in Akure North nearby government area of Ondo State, Nigeria, lies generally on latitude 70 09' 48.80" and longitude 50 45' 4.70" with height of 324.6 m (Ajayi *et al.*, 2010). Its main relief feature is lowland type of landscape grouped under the coastal lowland of Western Nigeria within the tropical rainforest region. Average annual rainfall of the environment was recorded as; for 2005 is 1007.25 mm, 2006 is 1142.51 mm and 1232.60 mm (Ministry of Agriculture and Natural Resources, 2018). According to the meteorological agency record, the geology and area factors of the site are predominance rainy environment, warm, damp and moist with at least 0.25 mm or more, the maximum monthly mean Relative Humidity is 89% and minimum of 67% and annual monthly mean Temperature is between 30.7°C and 21.05°C. The soil texture of the sample site is sandy clay loam which make it significantly useful for farming occupation. Figure 1; show the location of Akure in the map of Nigeria.

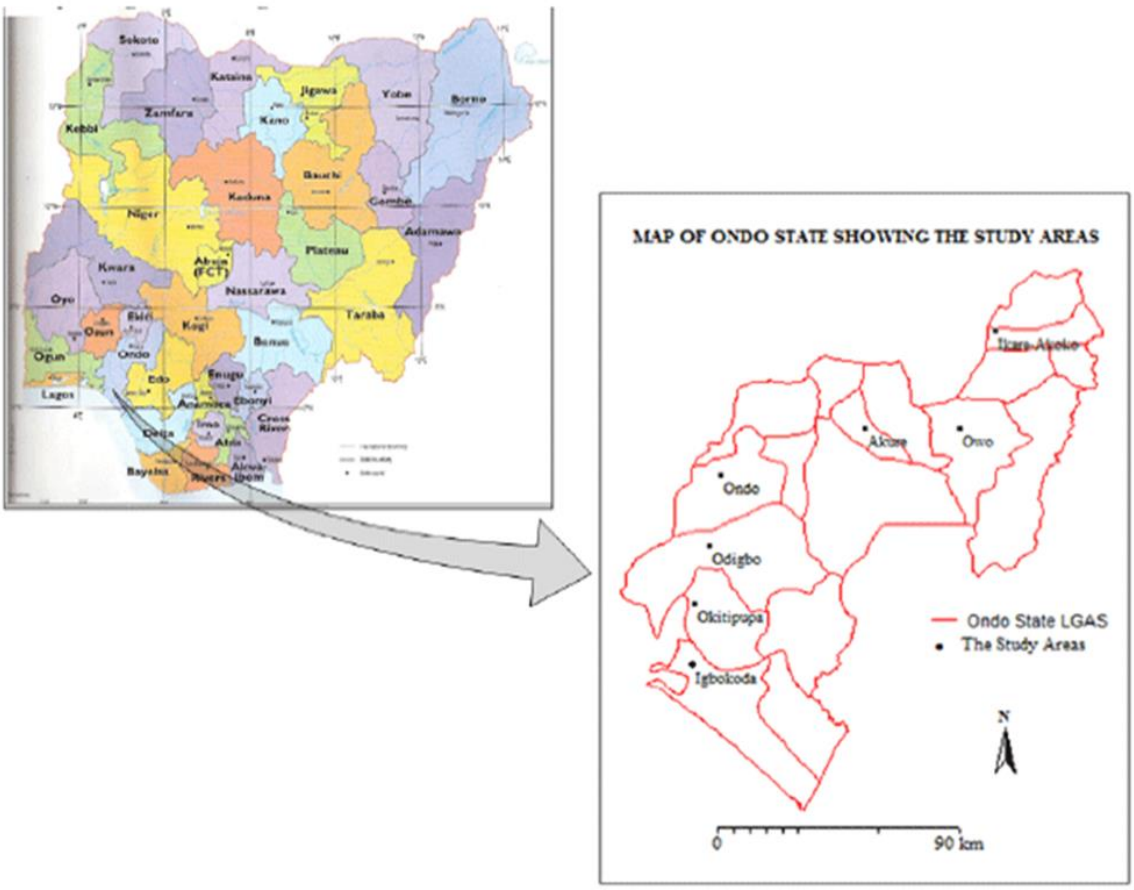

Figure 1. Study area shown in Nigeria map (Source: Ajayi *et al.*, 2010).

Sampling

Three chosen areas in Igbatoro road, named as A B C for soil samples liberated from cassava mill effluent were likewise collected from two distinct areas marked D and E (controls).

Soil auger fabricated from department of agricultural engineering Federal University of Technology Akure was used for collection of soils at different depth, with everyone examined at the lab. Range of soil depth collected are from 15 cm, 30 cm, and 45 cm. Each sample obtained were mixed thoroughly and kept in a black polythene bag labeled accordingly.

Sample preparation and analytical procedure

Both samples were taken to Chemistry laboratory for physical analysis at Federal University of Technology Akure, Ondo State, Nigeria. Air dried process was carried out on the samples for a period of a week to retained elements present in it. Homogenization was carried out after air drying through a 2 mm sieve. Atomic Absorption Spectroscopy (AAS) method was carried out for quantitative determination of chemical elements (Izah *et al.*, 2017). The digested samples were taken to Sustainable Agro-tech Nigeria limited near NNPC mega station, kilometer 4/5, Benin Ilesa Expressway, Akure, Ondo state for the heavy metal's determination. Those metals analyzed for are Na, Ca, K, Zn, Fe, Pb and Cr. The data obtained is subjected to statistical analysis. A one-way analysis of variance (ANOVA) was carried out to determine differences between the samples and to compare the contaminated samples of cassava mill effluent with the non-contaminated samples i.e., control samples to know the significant differences. Duncan's Multiple Range Tests (DMRT) has been utilized to isolate mean of the samples.

Determination of soil pH

The pH in water technique was utilized (Etta *et al.*, 2019). 5 g of each dried soil test was put inside a receptacle, 50 ml of refined water was added, and the blend mixed for 30 minutes with glass pole. The pH meter was normalized and adjusted with support arrangement of pH 4.10 and 9.20. The anodes of the pH meter were submerged into the halfway settled suspension and the readings were taken. The terminals were flush with refined water and cleaned dry with clean channel paper after each example perusing.

RESULTS AND DISCUSSION

The major texture of the soils obtained were sandy clay loam and effect caused by cassava effluent discharged on the soils is illustrated in physico-chemical properties of samples displayed on Table 1. The pH of soil samples receiving CME ranged from 7.91 to 9.24 and the one without CME ranged from 7.62 to 8.22, which is high compared to those of control sites and to maximum of 7 neutral of the guidelines recommended by Nigerian Federal Environmental Protection Agency (FEPA, 1991) and World Health Organization (WHO, 1983) as shows in Table 2 and these have serious implications on crops (Enerijiofi *et al.*, 2017). The alkalinity could be because of the presence of hydrogen cyanide in the CME (Etta *et al.*, 2019). Figure 2 shows that alkalinity increase with depth in each of the destinations of contaminated soil samples aside from site C and this is attributed to the CME processing going on at the soil surface at the time this research has been carried out. The highest soil pH recorded was 9.24 compared to other sites and depths, which shows the soil is more acidic observed at Site C at 0-15 cm depth. This is because of the sloppiness of the ground towards site D. Soil highest pH values recorded in this study are in similar reach with those revealed in a few related investigations Rashad and Shalaby (2007) ; Oviasogie and Ofomaja (2007). Soil pH decides the accessibility of supplements and the power of poisonous substances as well as the physical properties of the soil and availability of enhancements and the force of harmful substances as well as the actual properties of the soil (Izah *et al.*, 2017). The pH values of these concentrated location show an overall high propensity for high availability of the metals; hereafter, this expands the bet of heavy metals plant take up.

Total Organic Carbon (TOC) of 1.17% at Site B was the highest value recorded at 0-15 cm depth, which is the top agricultural soils, while low Total Organic Carbon was observed at Site A, depth 0-15 cm, this is due the stagnation of cassava waste water on the surface for a longer period compared to other sites. The phosphorus content of the soil is high and the highest value of 76.20 mg kg^{-1} was observed in Site B.

Table 1. Physicochemical properties of the soil samples.

Sample	Depth (cm)	Particles Size			Texture	TOC	pH	E/C	P	CEC
Contaminated soil		Clay	Silt	Sand		%		mg kg^{-1}	mg kg^{-1}	mol kg^{-1}
Site A	0-15	31	3	77	Sandy Clay Loam	0.02	8.45	0.62	46.75	1.23
	15-30	28	2	81	Sandy Clay Loam	1.09	8.90	0.55	43.82	0.95
	30-45	31	3	77	Sandy Clay Loam	0.86	8.63	0.51	45.72	0.91
Site B	0-15	17	2	80	Sandy Loam	1.17	7.91	0.29	71.10	0.49
	15-30	23	2	74	Sandy Clay Loam	0.12	8.01	0.25	76.20	0.94
	30-45	30	3	66	Sandy Clay Loam	0.08	8.66	0.42	69.80	0.72
Site C	0-15	18	1	76	Sandy Loam	0.66	9.24	1.31	55.50	1.63
	15-30	28	0	67	Sandy Clay Loam	0.09	8.80	0.87	55.70	1.00
	30-45	16	0	79	Sandy Loam	0.98	9.11	1.24	50.60	0.98
Control Soil										
Site D	0-15	17	1	76	Sandy Loam	0.70	7.62	0.05	68.30	0.84
	15-30	30	2	60	Sandy Clay Loam	0.47	7.82	0.00	70.20	0.85
	30-45	21	0	76	Sandy Clay Loam	0.78	8.22	0.00	69.20	0.83
Site E	0-15	20	1	78	Sandy Loam	0.78	7.84	0.10	68.20	0.74
	15-30	30	4	68	Sandy Clay Loam	0.37	7.84	0.11	70.10	0.75
	30-45	20	1	70	Sandy Loam	0.75	7.84	0.11	69.10	0.73

TOC %: Total Organic Carbon, E/C: Electrical Conductivity, CEC: Cation Exchange Contents, P: Phosphorus

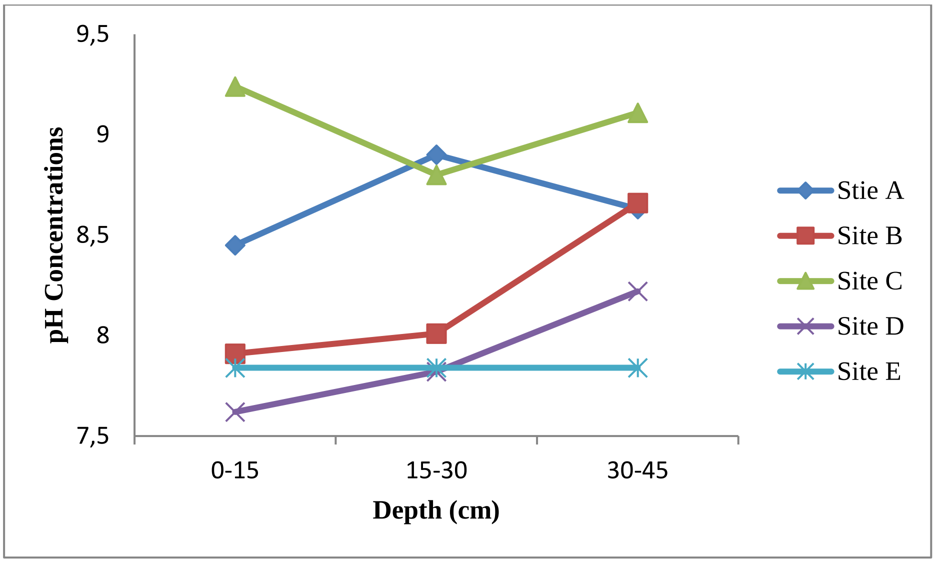

Figure 2. Soil pH Concentrations of CME soil samples at the sites locations.

The electrical conductivity of soil in the study areas ranges from 0.25-1.31 mg kg^{-1} for the soil samples receiving CME and the one without CME range from 0.00-0.1 mg kg^{-1}. Electrical conductivity is utilized for assessing soil saltiness (Izah *et al*., 2017). The Electrical Conductivity (E/C) and Cation Exchange Contents (CEC) are high in Site C with values of 1.31 mg kg^{-1} and 1.63 mol kg^{-1} respectively. This is because there is relationship between electrical conductivity of the soil and cation exchange. The qualities recorded in this study are because of expansion in concentration of soluble salts in correlation with the value recorded for control. The consequences of high electrical conductivity in soils are that there is sensible or huge presence of anions (Etta *et al*., 2019). The value in CME soil sample is still moderate in correlation with 4 mg kg^{-1} FEPA standards for soil quality.

Table 2. Concentration of heavy metals and non-heavy metals at various soil samples.

Sample	Depth (cm)	Heavy metals and non-heavy metals						
		Na	Ca	K	Cr	Zn	Fe	Pb
Contaminated soil		mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}
Site A	0-15	4.40	28.29	65.12	0.46	1.91	267.75	1.00
	15-30	4.00	14.59	51.72	0.52	1.39	258.75	1.00
	30-45	4.70	32.99	62.92	0.66	2.13	318.75	1.00
Site B	0-15	4.60	38.69	68.42	0.18	2.06	195.75	0.60
	15-30	3.00	24.72	49.32	0.97	1.78	338.75	1.10
	30-45	2.20	22.00	50.62	0.92	1.71	268.75	1.10
Site C	0-15	5.30	39.89	69.22	0.38	2.74	242.75	0.80
	15-30	4.90	36.09	66.52	0.43	2.65	298.75	0.80
	30-45	2.90	17.69	49.42	0.08	1.51	118.75	0.20
Control Soil								
Site D	0-15	3.10	18.19	49.92	0.75	1.08	226.75	0.90
	15-30	1.60	12.99	43.82	0.67	0.28	206.75	0.70
	30-45	14.00	14.09	42.62	0.40	0.21	228.75	0.80
Site E	0-15	3.00	22.39	53.12	0.26	1.82	152.75	0.40
	15-30	4.50	27.39	66.82	0.49	2.63	163.75	0.80
	30-45	5.60	34.39	69.32	0.87	2.64	263.75	1.10

The total organic carbon ranged from 0.02 to 1.17%. This value is because of the release of the CME for certain items in organic matter and recommends presence of compostable substances in the effluent. Total organic carbon values of this study resemble qualities announced by Osakwe (2012), but similarly lower than the qualities revealed somewhere else in one more related study by Tukura *et al.* (2007). High values of phosphorus recorded in this study are not unexpected because cassava tuber is a good source of phosphorus in correlation with Osakwe (2012) study. For the texture of the samples, they increase in the following order, soil molecule size, propagation of sand fraction clay and followed by silt.

Soil cation exchange values range between 0.49-1.63 mol kg^{-1}. Cation exchange capacity is honestly connected with soil capacity of adsorbing heavy metals (Odubanjo *et al.*, 2011).

Results of the investigation of physico-chemical properties exposed those mean concentrations of some of the heavy metals including poisonous ones as Zn, Fe, and so on were totally observed to be very high comparative with those of the control sites, where (aside from Cr and Pb) a large portion of them were either not identified by any stretch of the imagination (Table 2).

Although, for non-heavy metals since the control site recorded lower mean concentration for vast all (aside from K) which has higher mean concentrations. The mean concentration of metal contents in all the soil samples that is, sites A-E, are very high concerning Fe (338.75 mg kg^{-1}), K (69.33 mg kg^{-1}), Ca (39.09 mg kg^{-1}), Na (14 mg kg^{-1}), Zn (2.74 mg kg^{-1}), Pb (1.10 mg kg^{-1}) and Cr (0.97 mg kg^{-1}) in a specific order. Among the heavy metals, Pb (0.60 ±1.00 mg kg^{-1}) and Cr (0.30 ± 0.55 mg kg^{-1}) recorded worrisome mean concentrations. While Fe (220.08 ± 281.75 mg kg^{-1}) and Zn (0.30 ± 0.55 mg kg^{-1}) recorded the highest mean concentrations (Table 4), since the least of these concentrations has outperformed the cutoff points passable in soil by regulatory, FEPA, 1991 (Nigerian Federal Environmental Protection Agency) and WHO, 1983 (World Health Organization) (Table 3), with the exception of chromium which is still between the limit point of FEPA and WHO standard. The high scope of iron from the soil analysis in the study region shows the accessibility of some oxidized agents subsequently, is viewed as vital for chlorophyll synthesis which doesn't meet the FEPA rule limit for plant development and crop production will be massively reduced because of the pollution of the soil by CME which is similar to Etta *et al.* (2019) study. Moreover, regulatory data were not ethically accessible for most of the metals for the different ecological media, especially soil, in this manner making data examinations for safe restricts troublesome errand.

Table 3: Concentrations of heavy metals and non-heavy metals for soil samples (WHO, 1983; FEPA, 1991).

Elements	Results
Cr	2.00
Pb	0.01
Fe	0.30-1.5
Zn	3.00
Na	-
Ca	-
K	-
PH	7.00

Table 4. Mean concentrations of metals and non-metals of contaminated and control soil sample.

Metals	Contaminated samples			Control sample	
	Site A	Site B	Site C	Site D	Site E
Na	4.37±0.09[c]	3.13±0.21[a]	2.73±2.37[b]	2.00±0.03[b]	4.30±0.07[c]
Ca	25.29±0.16[d]	28.15±0.30[c]	30.62±0.67[c]	14.66±0.45[b]	27.99±0.08[d]
K	59.92±0.63[e]	15.26±0.61[b]	60.71±0.94[d]	44.58±0.99[c]	61.96±1.47[e]
Cr	0.55±0.02[a]	0.65±0.06[a]	0.28±0.02[a]	0.56±0.05[a]	0.52±0.03[a]
Zn	1.81±0.02[b]	1.81±0.04[a]	2.13±0.15[ab]	0.49±0.03[a]	2.32±0.04[a]
Fe	281.75±1.19[f]	254.99±17.97[a]	220.05±0.94[e]	217.20±5.76[d]	192.15±1.43[b]
Pb	1.00±0.07[ab]	0.86±0.06[a]	0.57±0.06[a]	0.75±0.06[a]	0.73±0.04[a]

**Difference in superscript in a column means there is significant difference*

In this study DMRT analysis was used to measure which metal has the least concentration (superscript a-e) in the soils in the different sites. The Duncan multiple range test (DMRT) showed that the CME concentration had significant effect in on the Cr, Fe, Pb, K, Ca contents of the soil for all the sites (Tables 5). Impact of CME concentration on Site A showed that Cr (0.55±0.02[a]) and Pb (1.00±0.07[ab]) has the lowest concentration compared to other metal. In Site B the lowest metals are Na (3.13±0.21[a]), Cr (0.65±0.06[a]), Zn (1.81±0.04[a]), Fe (254.99±17.97[a]) and Pb (0.86±0.06[a]). Site C the lowest concentration ranged from Cr (0.28±0.02[a]), Pb (0.57±0.06[a]) and Zn (2.13±0.15[ab]). Site D has its lowest ranged of metals from Zn (0.49±0.03[a]), Cr (0.56±0.05[a]) and Pb (0.75±0.06[a]). While Site E has east metal concentration for Cr (0.52±0.03[a]), Zn (2.32±0.04[a]) and Pb (0.73±0.04[a]). It was observed that the least common metals with low concentration are Cr, Zn and Pb, this was also reported Odubanjo *et al.* (2011) study. The concentration of the relative multitude of metals investigated in the soil getting CME in site B and C diminished down the profile aside from K and Cr (Table 2). Higher increase in concentration of K and Fe as well as the presence of Na and Ca in cassava effluent demonstrates the way that it tends to be utilized as a bio-compost. The dissemination of heavy metals concentration in CME soil showed that it was by and large higher at the topsoil than the sub and base soils except for site A where might be a few synthetic tasks, for example, percolation, infiltrations draining e.t.c which had occurred on the soil surface before samples were collected. This higher level of metals on the topsoil is normal since the topsoil is the resource with CME. The level of heavy metal for all the locations was altogether higher than the levels seen in the control site asides from site E which may come about because of the interaction utilized for collecting the soil sample, or at least, when the soil is excessively hard for the soil auger to drill in, it was currently wet with water.

This infers that the contamination degree increment is dependent on the heavy metals due to the effluent from the cassava mill to the soil because of the nature of the soil texture. Fe is mostly concentrated in the site as shown in Table 4, which agrees with Aluko and Oluwande (2003) that soils concentration is Fe based. Contamination of Fe cannot indisputably be connected to waste cassava effluent but can be from other sources Eddy *et al.* (2003). Nonetheless, express degrees of Fe in soil points to uncontrolled site which is very near the mill while sites far from it are show low concentration of Fe, this could have been because of cassava mill effluent exposure of Fe in the soil examined and this result agrees with Odubanjo *et al.* (2011). Nonetheless, for a large portion of the soil tested, it was observed that degrees of Ca, K, and Fe, are likewise very high and could be owing to the way that these groups of metals constitute more of east crust metals (Mitchell, 1964). Also, it could be climate reaction on the soil (Aubert and Pinta, 1977), like heat and humidity in general thereby, changing potassium (K) degree from 20 to 5000 ppm. Soil metals exposed in this region have severe wellbeing inference on inhabitants living in that environment, inventory wellbeing impacts related to openness of the site to poisonous heavy metals.

Penetration of the metal in groundwater, can cause contamination and pollute the rivers in communities surrounding the mill, drinking the water can damage the liver, gastrointestinal tract (Adedara *et al.*, 2011). Body tissues and organs are damaged by encountering toxic heavy metals (WHO, 1996). Also, it can kill silently because if compiles itself in body before eventually leading to death (Nriagu, 1988). People living around in the study area are on the risk of a silent epidemic, because of findings in the research.

Table 5. Chemical composition cassava mill effluent effect on soil samples and control soil samples.

Elements	**Sources of variation**	**DF**	**SS**	**MS**	**F ratio**	***F-value***	
	CME SAMPLES						
Cr	Treatment	2	-0.688	-0.344	-2.765	*3.40*	**
	Error	24	2.930	0.124			
	Total	26	2.296				
	CONTROL SAMPLES						
	Treatment	1	-0.876	-0.876	-4.133	*4.96*	**
	Error	10	2.120	0.212			
	Total	11	1.244				
	CME SAMPLES						
Zn	Treatment	2	-10.508	-5.245	-3.503	*3.40*	**
	Error	24	35.938	1.497			
	Total	26	25.430				
	CONTROL SAMPLES						
	Treatment	1	-5.273	-5.273	-3.503	*4.96*	**
	Error	10	15.053	1.505			
	Total	11	9.780				
	CME SAMPLES						
Fe	Treatment	2	-175251.75	-87625.87	-5.219	*3.40*	**
	Error	24	402952.316	16789.680			
	Total	26	227700.568				
	CONTROL SAMPLES						
	Treatment	1	-114293.76	-114293.8	-4.538	*4.96*	**
	Error	10	251841.618	25184.162			
	Total	11	137547.86				
	CME SAMPLES						
Pb	Treatment	2	-1.892	-0.946	-3.311	*3.40*	**
	Error	24	6.856	0.286			
	Total	26	4.961				
	CONTROL SAMPLES						

	Treatment	1	-1.636	-1.636	-4.368	*4.96*	**
	Error	10	3.745	0.375			
	Total	11	2.109				
	CME SAMPLES						
Na	Treatment	2	-42.577	-21.288	-3.463	*3.40*	**
	Error	24	147.537	6.147			
	Total	26	104.960				
	CONTROL SAMPLES						
	Treatment	1	-26.853	-26.853	-3.789	*4.96*	**
	Error	10	70.873	7.087			
	Total	11	44.020				
	CME SAMPLES						
Ca	Treatment	2	-2137.933	-1068.967	-3.362	*3.40*	**
	Error	24	7630.713	317.946			
	Total	26	5492.79				
	CONTROL SAMPLES						
	Treatment	1	-1227.082	-1227.082	-4.14	*4.96*	**
	Error	10	2963.192	296.319			
	Total	11	1736.110				
	CME SAMPLES						
K	Treatment	2	-14013.291	-7006.645	-5.361	*3.40*	**
	Error	24	31369.131	1307.047			
	Total	26	17355.840				
	CONTROL SAMPLES						
	Treatment	1	-7828.035	-7828.035	-4.522	*4.96*	**
	Error	10	17312.905	1731.291			
	Total	11	9484.870				

Hints: MS- Mean of Square, DF- Degree of Freedom, MS- Mean of Square, SS- Sum of Square
Cr-Chromium, Zn-Zinc, Fe-Iron, Pb-Lead, Na-Sodium, Ca-Calcium, K-Potassium
*** means significant difference, *means non-significant difference*

CONCLUSION

This study showed that for physico-chemical properties of soil samples receiving the cassava mill effluent increases in pH along the soil profiles for all the samples, this leads to higher levels of available K, and conductivity capacity of the soils which revealed that CME had noticeable accessibility on chosen physico-chemical. The soil samples analytical results showed that CME has immensely polluted the soil and made it unfit for agricultural activities. It is on this note that it's concluded that CME had both negative and positive effects on the study area and its environs. Educating campaign should be given to the processor by the Agricultural extension workers on how to detoxify CME in accordance with FEPA and WHO standards. Appropriate methods of disposal of both solid and liquid effluent from cassava are recommended for save and healthy condition of Igbatoro road environment. Further study should be carried out on converting cassava effluents into more useful materials and potential usage as biofertilizers.

DECLARATION OF COMPETING INTEREST

The authors declare that there is no conflict of interest.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

This research work was carried out in collaboration with the authors (Famuyini and Sedara).
John Famuyini contributes to the investigation, methodology, writing - original draft.
Adewale Sedara contributed in the section of review and editing.

ETHICS COMMITTEE DECISION

This article does not require any ethical committee decision.

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