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ASSESSMENT OF THE HEAVY METALS AND METALLOID IN CASSAVA ROOTS GROWN IN EBEDEI (AN OIL BEARING COMMUNITY) DELTA STATE NIGERIA

Ogwu, C.[1], Onuelu J.E.[2], Awowede, M. A[3].

[1] Department of Environmental Management and Toxicology,
Delta State University of Science and Technology, Ozoro
[2] Department of Pharmacology, Delta State University, Abraka
[3]Department of Vocational Education, Delta State University, Abraka

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Abstract: **This study investigated the heavy metals and metalloid contents in cassava roots grown in Ebedei oil producing community for its suitability for human consumption. The study was an ex-post facto research that answered 3 research questions and tested a hypothesis. In achieving these, the study area Ebedei was mapped out into 5 research grids corresponding to the quarters that make up Ebedei clan. Cassava roots were collected from 5 farms in each sample grid, bulked and composites taken and stored for analysis. The analytical standard adopted was USEPA 200.8 and the instrument for heavy metals determination used was Agilent ICP-MS triple quadrupole model 7900. The mean results obtained; were Cd, 0.03±0.11 mg/kg Cr, 0.03±0.12 mg/kg, As, 0.03±0.11 mg/kg, Cr, 0.03±0.11 mg/kg and Pb 0.003±0.11 mg/kg. The mean results of metals and metalloid were subjected to test of significance with ANOVA using SPSS model 29 at 0.05 level of significance, the *p* value was 0.62 thus accepting H_0. The study concludes that the heavy metals and metalloid content in the cassava roots are within acceptable limits. It recommends that cassava should continue to be grown and harvest be consumed, in Ebedei soil, the oil company operating in Ebedei should continue to adopt world best practices in its operations and the National Environmental Monitoring Agency NESREA is advised to continue to keep watch on the oil company in Ebedei.**

Keywords: **oil exploitation, heavy metals, soil contamination, cassava cultivation, bioaccumulation, human health.**

1. INTRODUCTION

Nigeria is an agrarian country with agriculture engaging vast majority of its population. The major crops grown are rice, beans, maize, tomatoes and cassava (Ndukwe, 021, Onwualu, 2020, Adelabu, 2016). Cassava is the major arable economic crops cultivated in large quantity in Nigeria (Adejumo, 2015, Osagie, 2016) and Nigeria rank as the world greatest producer (Food and Agricultural Organisation, 2021, World Food programme, 2020, National Bureau of Statistics, 2022). Nigeria annual cassava production is 60 million metric tonnes per annum closely followed by Indonesia 24 tonnes per hectares per annum (FAO, 2020, WFP, 2020, Adamu, 2022). Cassava in Nigeria is produced in 24 out of 36 states (Yerima, 2021, Odein, 2020, Biobatu, 2022). It is the main source of income for many rural economies in Nigeria (Ruwani, 2021, Abe, 2020). Cassava is also the major stable food in Nigeria contributing positively towards the achievement of food security (Thanni, 2020, Okeghene, 2018). It is used in pharmaceuticals, cosmetics and textile manufacturing (Jones, 2023, Macauley, 2018, Harrison, 2018). It is also used in beverage manufacturing, as adhesive, starch and cellulose (Johnson, 2020, Seth, 2015).

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Cassava is equally used for bioethanol manufacture, as biopolymer and as animal feeds (Benson, 2020, Johnson, 2018). Nigeria is 11th global oil producing country and the nine oil producing states in Nigeria are also the major cassava producing states (Ogwu et al., 2023, Ogwu et al., 2021, Adejumo, 2022). Oil production is associated with spillages and Niger Delta experienced 822 oil spill cases between 2020-2023 with 28,003 barrels of crude spewed into the environment (National Oil Spills Detection and Response Agency, 2023) Oil spills results from equipment failure, tank wash, pipeline ruptures, wellhead blowout (Ogwu, et al., 2022, Ogwu et al., 2021). Crude oil is composed of carbons, hydrogen, Nitrogen, sulphur and variable quantities of heavy metals (Ogwu et al., 2022, Ogwu et al., 2022). Heavy metals in soil environment results in bioaccumulation and biomagnification of the metals in the crops cultivated in the soil environment. (Zhao, 2022, Ogwu et al., 2023, Voegborlo et al., 2012) and the ingestion of heavy metals contaminated food results in varying health complications such as cardiovascular diseases, cancer, memory loss, bones degenerations and death (Castro-Gonzalez & Mendez-Armenta, 2008, Busaidi et la., 2008, Rahmen et al, 2012).

The focus of this study is the assessment of the heavy metals content in cassava roots grown in Ebedei oil bearing community. The heavy metals investigated are Cd, Cr, As, Pb and Co.

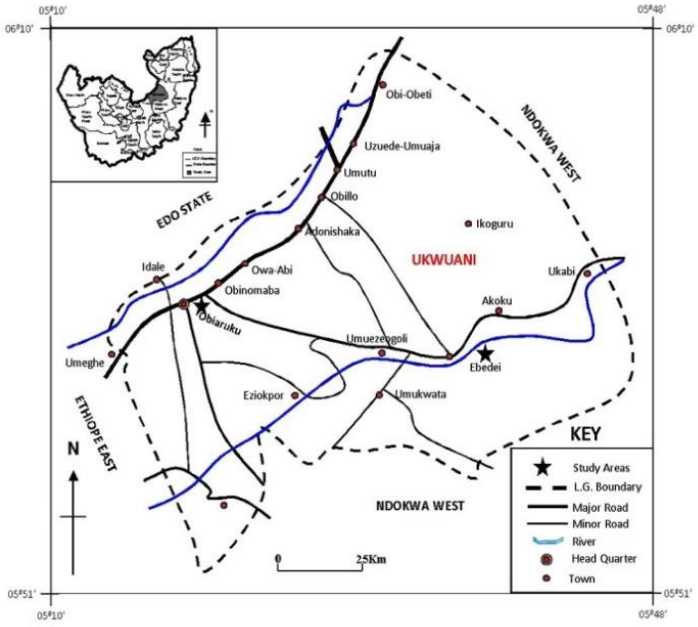
The study was guided by research question as below

1. what are the concentrations of Cd, Cu, Pb, Ni and Cr in cassava root grown in Ebedei soil?
2. are the concentrations of the heavy metals in the cassava roots within the maximum permissible concnetrations (MPC) stipulated by World Health Organisation for food crops.
3. are cassava roots grown in Ebedei soil fit for human consumption?

The study was guided by hypothesis as stated below:

H_0 there is no significant difference between the concentrations of the heavy metals in cassava roots harvested in Ebedei and WHO MPC for heavy metals in foods.

Study Area



Source: Ojeh, N. V. (2012)

Figure 1: Map of Ebedei

Ebedei is a sparsely populated linear settlement in Ukwani local government area, Delta state. It is situated between latitude 5°51N and 6°10'N and longitude 5°10E and 6°40'E with a land area of 4 km sq and a population density of 40, 056 (National Population Census, 2006). Ebedei is flanked at the west by River Ethiope. Ebedei people are predominantly farmers. Some are artisans, some are sand miners while some are civil servants working as teachers in the schools in the settlement few of the inhabitants work in the oil company; Seplat Oil Company Plc.

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2. MATERIALS AND METHODS

Grid sampling techniques was adopted in this study. Ebedei was mapped out into sampling grids corresponding 60 the quarters that make up the community and these are Obi-ilo, Ukwole, Adoni Ashaka and Umuosele Ilo. From each of the sample grids, cassava roots measuring 5-10 grams were collected from 5 farms bulked and composites taken and, stored before taken to the laboratory for analysis.

Analysis

The analytical standard adopted for this study is United States Environmental Protection Agency method 200.8 as described by (Meche et al., 2010, Mustafa & Guluzar, 2003).

The cassava roots selected from each sampling grids, were thoroughly washed with clean water and rinsed with double distilled water. The barks were then peeled with stainless scrapels and washed again and rinsed with deionised water. The roots were then oven-dried at 105° for 12 hours using Agilent door oven model 3250 and the dried roots were crushed with Agilent laboratory blender/homogenizer.

5 g from each of the sampling grid were weighed out into beaker and digested with nitric and perchloric acid at ratio 1:1 and the mixture heated at 200° again for 1 hour in Agilent door oven model 3250. The digests were allowed to cool for 2 hours and determination of the metals were carried out with Agilent inductively coupled plasma mass spectrometry (ICP-MS) triple quadrupole model 7900.

3. RESULTS

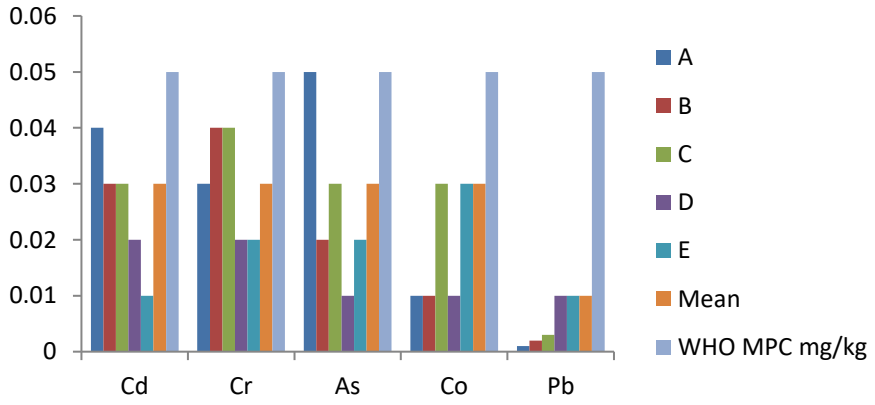
The results of the analysis of the heavy metals in cassava roots grown in Ebedei are as in Table 1.

Table 1: results of the analysis of the heavy metals in cassava roots grown in Ebedei and WHO MPC for heavy metals in food crops.

Heave metals	A	B	C	D	E	Mean	WHO MPC mg/kg
Cd	0.04	0.03	0.03	0.02	0.01	0.03	0.05
Cr	0.03	0.4	0.04	0.02	0.02	0.03	0.05
As	0.05	0.02	0.03	0.01	0.02	0.03	0.05
Co	0.01	0.01	0.03	0.01	0.03	0.03	0.05
Pb	0.001	0.002	0.003	0.001	0.001	0.002	0.05

The results of the heavy metals in cassava roots grown in Ebedei oil bearing community were presented in graph as in Figure 2.

Figure 2: results of the heavy metal content in cassava roots grown in Ebedei oil bearing community and WHO MPC in mg/kg.



The mean results of the heavy metals investigated were subjected to test of significance deploying special package for social science (SPSS) model 29 at 0.05 level of significance. The p-value was 0.64 thus accepting H_o.

4. DISCUSSION

The analysis of cassava roots grown in Ebedei oil producing community presented varying concentrations of the metals measured. The concentrations of Cd between from 0.01 mg/kg to 0.04 mg/kg with a mean concentration of 0.03 mg/kg. The maximum acceptable limit for Cd in food is 0.05 mg/kg. Low concentration of Cd in food was in (Ekundayo et al., 2014, Ogwu et al., 2023). The content of Cr in cassava roots cultivated in Ebedei oil producing communities as shown by the analysis was between 0.02 mg/g to 0.04 mg/kg with a mean of 0.05 mg/kg. WHO MPC for Cr is 0.05 mg/kg. This report is similar to the reports in (Adebayo et al., 2014; Ogwu et al., 2022).

The laboratory analysis of the cassava roots grown in Ebedei showed that the concentrations of As was between 0.01 mg/kg to 0.05 mg/kg with a mean concentration of 0.03 mg/kg, the WHO MPC for As is 0.05 mg/kg. This low As concentration report is similar to (Goror et al., 2012, Amiard et al., 2006, Eister 2010, Ogwu, 2021). The concentration of Co, the analysis of cassava roots in Ebedei farms revealed was between 0.01 mg/kg to 0.03 mg/kg with a mean concentration of 0.03 mg/kg. The WHO MPC for Co in food is 0.05 mg/kg. This report is in tandem with (Dural et al., 2007, Qader & Malik, 2011, Dhaneesh et al., 2012, Adverisoldwage & Marx, 2000). The Pb content of the cassava roots in Ebedei ranged between 0.011 mg/kg to 0.003 mg/kg with a mean concentration of 0.02 mg/kg. The WHO MPC for Pb is 0.005 mg/kg. Low content of Pb in crops grown in oil bearing communities was report in (Abu-Halal & Ismail 2000, Khalid, 2004, Abdallah, 2004, Nweze et la., 2014).

5. CONCLUSION

The economic importance of crude oil in Nigeria economy can not be overemphasized as it is the life wire of Nigeria. Oil exploration and exploitation most often than non are accompanied with environmental abuse of varying proportions corresponding to the magnitude of spills and spills frequencies and these bioaccumulate in crops grown in the soil environment. The analysis of the cassava roots grown in Ebedei oil bearing community presented low content of all the metals considered and this shows that the oil company operating in Ebedei has been operating with world best practices and in-line with guidelines laid down by National Environmental Standards Regulation and Enforcement Agency.

Consequent upon this, it is recommended that cassava should continue to be grown in Ebedei soil because heavy metals pollution level is low. The oil company is enjoined to continue to operate within the standards stipulated and the monitoring agency national Environmental Standards and Regulation Enforcement Agency (NESREA) is encouraged to continue with the surveillance on the oil company.

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