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Cassava Processing and Heavy Metal Concentrations in Soils of the Riverine Community Toru-Ebeni, Bayelsa State, Nigeria.

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Abstract

Heavy metals in soils with cassava processing activities in Toru-Ebeni, Sagbama, Bayelsa State, Nigeria was investigated. This was intended to determine the relationship between cassava waste (effluents) and heavy metals in soil because of its grave implications on human health. Three sampling sites were chosen. Two of the sites had cassava processing activities while the control site had no cassava processing activities on it. Soil samples were collected in triplicates and analyzed for heavy metals using standard procedures. Heavy metal variables from the three sites were compared by using a one way ANOVA. The result show that copper (Cu) was significantly lower (P<0.05) in the control soil (O.664±0.02 mg/l) when compared with the processing sites (1.145±0.216mg/l and 2.143±0.31 mg/l). Similarly Lead (Pb) was significantly lower (P<0.05) in the control (3.55±.030mg/l) than in processing sites (3.817±.050, 33.30±4.73mg/l). Nickel (Ni) was lower in the control (0.430±0.011) than in the processing sites (0.9123±0.02mg/l and 0.62411± 0.12mg/l). Chromium (Cr) was also lower in the control (0.323±0.02mg/l) than in the processing sites (0.923±0.022mg/l and 0.6411± 0.11mg/l). Although the amount of Cadmium (Cd) was higher in the control site (0.08±0.16) than in the processing sites (0.032±.081, 0.043±.091**), t**he difference was however not significant (P>0.05). It can therefore be concluded that the presence of cassava processing activities has a marked effect on the availability of heavy metals in the soil. Effective control of cassava processing activities is important, in order to prevent health, ecological and economic loss due to illness and loss of biodiversity.

Key words: Cassava, Heavy metals, Soil, Processing, Toru - Ebeni

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1.0 Introduction

Cassava and its many directives are the staple foods of the people of the Niger Delta in Nigeria. Its consumption exceed that of rice, wheat and maize combined. It is so widely accepted that global production of cassava may now exceeds 45784 million United States Dollars because of its added values as it is processed into a myriad of important local food types such as fufu, garri, tapioca and even starch. Sadly, the cassava processing process into food items generates a lot of waste (effluents) and offensive odour. Apart from the unbearable smell, presence of poisonous gases and a general unhealthy environment, the problem of heavy metal contamination of soils through the gamut of cassava processing possess a more epochal problem. Heavy metals may enter soils in cassava processing sites from cassava tissues already contaminated from other sites preceding harvest or by chemical substances.

Heavy metal in the soil may trigger a myriad of health and environmental problems. Plants absorb heavy metals from soils at high concentrations which result in a great health risk to man due to food-chain transfers. As cassava is the most cultivated and consumed crop in Toru-Ebeni, there is a justification to monitor the soil characteristic of soils in the community around processing sites as to determine its heavy metal content. This will provide useful information and therefore determine the safety to the environment and human health.

2.0 Materials and methods

2.1 Collection of soil samples

Soil samples were collected in triplicateS randomly at depths of 15-30 cm using a shovel within the periphery of the cassava processing facilities. The soil samples were sun-dried before put into

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a 2 mm sieve mesh to separate out the fine particles. The sample was then kept in a chest freezer before chemical analysis.

2.2 Analyses of Heavy Metals

Soil samples were weighed (2g) into a conical flask and hydrochloric acid and de-ionized water was added to the content put into 50ml volumetric flask. A blank was prepared without soil sample. The extracted solution is poured into polythene bottles from where each sample was analyzed for Cd, Cu, Cr, Pb, and Ni using Atomic Absorption Spectrophotometer model 205 and the results expressed on dry weight basis.

Plate1: Station 1 (Control) with no cassava processing activity

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Plate 2: Station 2 cassava processing activity (grinding and pressing mill)

Plate 3: Station 3 cassava processing activity (grinding and pressing mill)

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3.0 Result

Table 2. Heavy Metals Found in Different Soil Samples at Contaminated Sites

Staions/WHO	Heavy Metals (mg/kg)				
	Ni	**Cr**	**Pb**	**Cd**	**Cu**
S1	0.430±0.011	0.323±0.01	3.5541±0.30	0.0860±0.16	0.6642±0.02
S2	0.9123±0.02	0.923±0.22	3.8172±0.50	0.0322±0.81	1.1446±0.21
S3	0.6241±0.02	0.6411±0.11	33.3021±4.73	0.0438±0.91	2.1432±0.31
WHO	0.02	0.02	0.01	0.05	2.0

Source: Field work, 2018 and WHO [1].

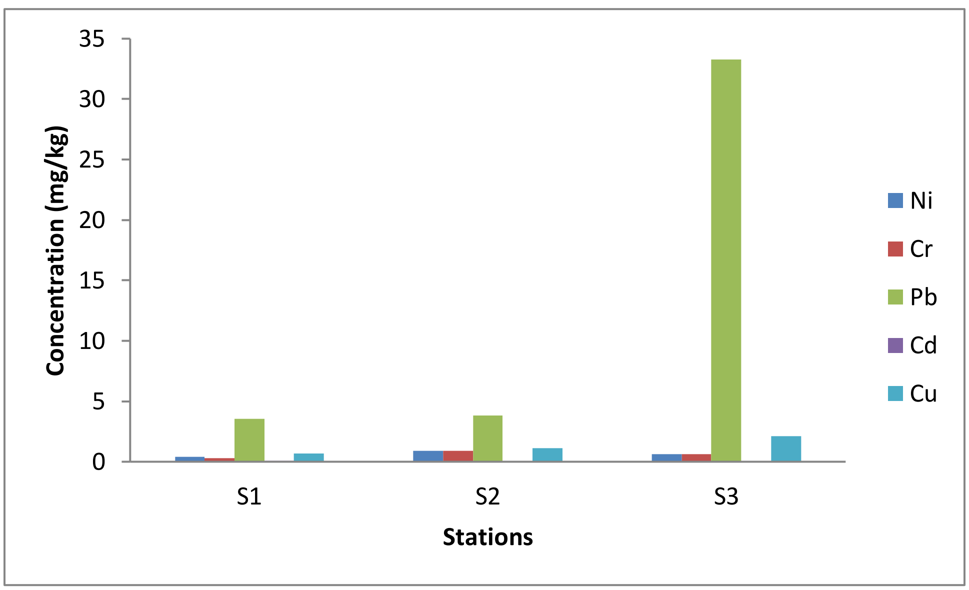

Figure 1: Heavy metal concentration in study stations

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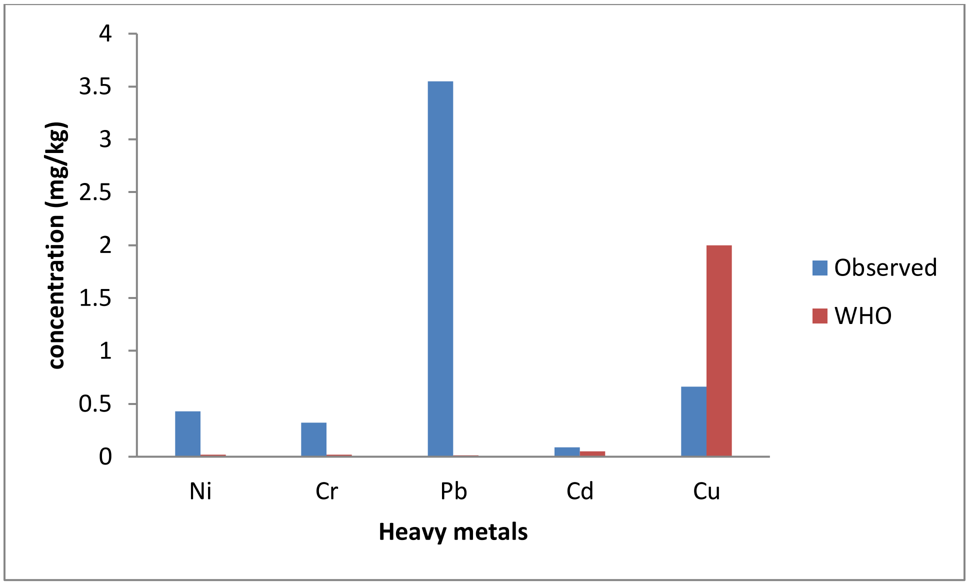

Figure 2: Heavy metal content in stations 1(Control)

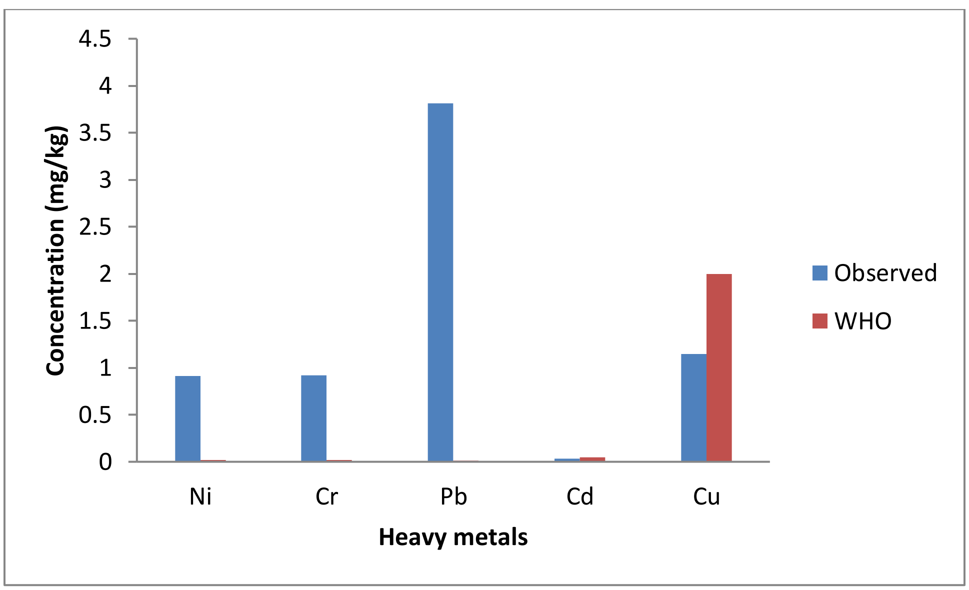

Figure 3: Heavy metal concentration in study stations 2

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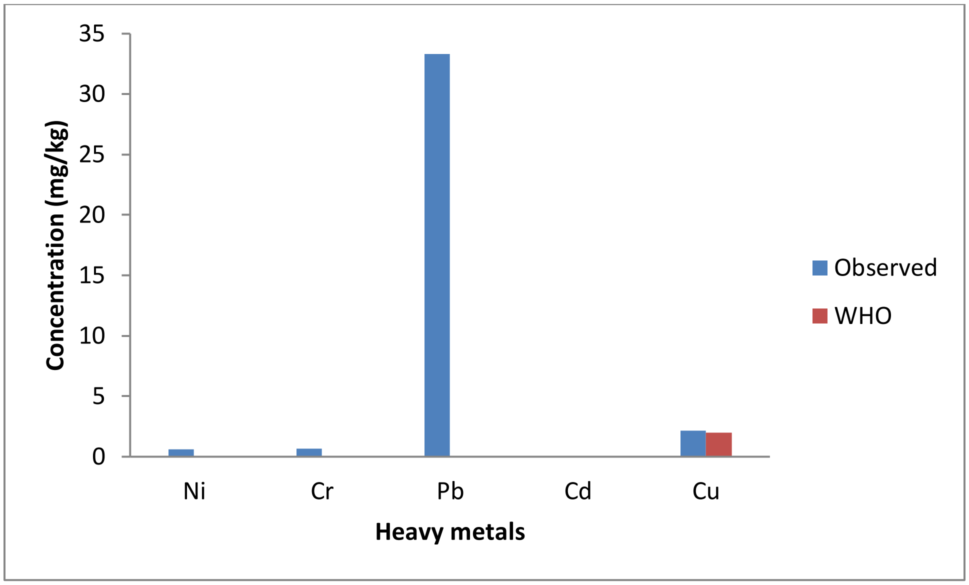

Figure 4: Heavy metal concentration in study stations 3

4.0 Discussion

The result of this study show different heavy metal concentrations for the different metals examined. In comparison, the observed levels of Cd in this study are similar to levels previously noticed for soils of some polluted sites [2,3]. In contrast, elevated levels of Cd in soils have been reported in Nigeria for some other study sites [3, 4, 5]. The presence of Cd in study sites in this study may be due to engine oils, grease and used tyres that are mostly used as support belt in machine and other connected wastes.

This study also discovered low levels of Pb in all sites which corroborates with the findings of other scholars in some sites in Nigeria`[5, 6]. However, some other scholars reported higher levels of Pb in some contaminated sites [3, 4, 7, 8]. Concentration levels observed in this study are higher than concentration of Cu reported for soil of waste dump sites, mining areas and foam

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manufacturing industry [5, 6, 9]. However, higher levels of copper have been recorded in some contaminated sites [3, 10]. One possible source of copper in these sites may be due to cassava grating machine engine wear and cassava wastes.

The concentrations of chromium observed in these sites range from 0.323 to 0.923mg /kg. All sites have chromium concentration higher than that of the control station without cassava processing activities.. Nwajei *et al.* [11] and Oviasogie and Omoruyi [5] also observed corresponding low levels of chromium in surface soils under waste dumps and soils around foam manufacturing industry respectively.

Ni concentrations were lowest in the control site than in the processing sites. Ni together with Pb are anti-knock fuel additives especially in burning fuel (diesel) that are used in operating these mills [12, 13]. This perhaps explains their higher levels where the grating and grinding machines are used.

Also, presence of one heavy metal affects the availability of another in the soil. In other words, antagonistic and synergistic behaviour exist among heavy metals as they tend to either attract each other in bond formation or repel each other due to ionic incompatibility. .Salgare and Acharekar [14] observed that the repressive effect of Mn on the total amount of Carbon was restricted by the presence of Cd. Similarly, Cu and Zn together with Ni and Cd have been reported to contend for the same membrane transport in plants [15]. In contrast however, the presence of Cu increased the bio-availability and indeed perniciousness of Zn in spring barley plant [16].This imply that interrelationship between heavy metals is intricate and responsible for the distribution of heavy metals observed.

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Physical properties such as moisture content and water holding capacity have a direct relationship with metal contents in soils [17]. The topography of yenagoa is clayey soil with large water retention capacity. This may explain the high uniformity of heavy metals in all the study stations.

5.0 Conclusion

Cassava has been identified as an important root crop, especially to the people living within the West African sub-region. This is due to the numerous end-products that are obtainable from the crop. However, processing cassava into the various end-products is usually associated with some waste which could be harmful both to the environment and the economy. To minimize this negative effect, proper treatment of cassava waste prior to disposal has been advocated. This study has further asserted the fact that cassava processing effluents have a pronounced preponderance on heavy metal levels in soils.

Considering the risk that heavy metals pose to the environment and human health, it is advocated that Government should be actively involved by legislating on the proper and appropriate method of cassava waste disposal. It should also mount an enlightenment campaign, through the mass media, as a way of educating the populace on the negative effects posed by the improper disposal of cassava waste.

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