Quest Journals
Journal of Research in Agriculture and Animal Science
Volume 7 ~ Issue 7 (2020) pp: 12-17
ISSN(Online) : 2321-9459
www.questjournals.org

Research Paper

Heavy Metal Contamination Status of Teifera Occidentalis (Fluted Pumpkin) Grown In Uzere Oil Rich Community, Niger Delta

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***ABSTRACT**:*
This study investigated the concentration of heavy metals in T. occidentalis grown in Uzere oil producing community. To achieve this, the research station Uzere was mapped out into research stations corresponding to the quarters in Uzere. From each of the research stations five samples of edible portions of T. occidentalis were sampled bulked, composites drawn, wrapped in absorbent paper labeled and taken to the laboratory for analysis. The analytical standards adopted were USEPA and APHA and the analytical, Instrument employed is Agilent atomic absorption spectrophotometer model 240A. The results obtained were Cu; 29.01 ±0.06mg/kg, Zn; 36.61± 0.09mg/kg, Mn; 150 ±0.24mg/kg; Co; 6.41 ± 0.06, Cr; 22.03 ± 0.03mg/kg. The results of the concentrations of the metals investigated were further subjected to test of significance with ANOVA with denominator 20 and numerator 4 at 0.05 level of significance The F. ratio calculated value is 4.83 while F ratio critical value was 2.87. Thus rejecting Ho. The study recommends that the oil companies operating in Uzere should adopt the world best practices to reduce environment degradation, gas flaring should be discontinued and gas gathering adopted and remediation of the soil should be commissioned. Teifera occidentalis should not be cultivated and consumed in Uzere until the soil is certified healthy.

***Keywords**: Oil exploitation, Teifera occidentalis, heavy metals, bioaccumulation and bio-magnifications, Human health*

***R**eceived 08 December, 2020; **A**ccepted 24 December, 2020 © The author(s) 2020.*
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I. INTRODUCTION

Vegetables are vital components of human diet as they are the prime sources of mineral fibre and vitamins (Uddia, Hasan & Dhar, 2019; Jeewan 2015; Ros, Bueno-De-Mesquita & Kampman 2012). Vegetables also contain electrolytes, phytochemicals especially antioxidant (Kaur & Kapoa, 2001, Southern 2000; Kabat, Park, HollenbeekSchatzkim & Rihan 2010; Castejon & Casado, 2011; Veon, Kim & Sung 2012). Intake of vegetables and fruits have been associated with the preventation of various chronic diseases such as hyperchidesferolemia, osteoporosis, high blood pressure, cancer chronic obstructive pulmonary disease as well as mental health (Paynme, Steek, George & Steffens 2012; Celik & Topcu, 2006; Park, & Park 2011; Slavin & Lioyd 2012). The world vegetables production have been bedeviled with contaminations from industrial effluents discharges, (Park, et al, 2016) Poma, Manani & Unique 2016; Shields, Lee & Murphy 2012; Sim et al., 2017; Tesauro, et al, 2013). The contaminants of vegetable include: polychlorinated biphenyls (PCBs), furans, dioxins, aromatic hydrocarbons, pesticides residues, micro plastics, heavy metals and others. (Yaron & Romling, 2014; Kelkothhaile & Spanoghe 2011; Maltison, et al, 2010; Lindow & Brand 2003; Giden, Heffling & Sattler 2010; Marian, Anduja & Attende 2016). Heavy metals contamination lead to varying health complications such as cancer, chronic respiratory diseases, diseases of the blood vessels, diabetes, kidney failure and cardio vascular disorders (Nwajei 2018; Asagba 2019; Zohair, Salim, Soyibo & Beck 2006; Ehuang, Macbride, Xia, Li & Li, 2009; Zhao, Xia, Fan Zhao & Shen 2012; Yang, Xu, Liu, He & Lang, 2011).

Nigeria is an oil and gas producing country, oil and gas account for 80 percent of the gross domestic product and 90 percent of its export earnings (Sanusi 2017; Adeosun 2017; Ruwani 2019, Oteriba 2018). The oil producing hub of Nigeria is the Niger-Delta. The Niger Delta occupies an area of 700,000km^2 sitting directly on

the gulf of Guinea on the Atlantic Ocean. (Osintokun 2006; Onosode 2014; Aworawo 2016; Haruna 2012; Elene 2014) etc.

The Niger Delta has suffered several cases of oil spills between 1970 till date. (Nigeria National Petroleum Cooperation (NNPC) 2015; Okecha 2003; Anyegbunan, 2006; Friends of the Earth 2014; Nigeria Society for Environmental Management 2015). Sources of petroleum in the environment include oil spills, equipment failure, tank wash, ballast water, floods and gas flaring (Susu, Abowei & Onyeme 2006; Okecha 2003; Leahy & Conwell 2008, Kaladumo 2015, Le, Xu & Zle 2014; Obigbo & Ugo 2013). Petroleum is composed of carbon, hydrogen, oxygen, sulphur and heavy metals (Rutz & Gez, 2015, Niko, Jane & Zen 2014; Abas & Ugbo 2013; Susu, Abowei & Onyeme 2013)

Teifera occidentalis is a perennial vegetable grown extensively and consumed in the Niger-Delta and Nigeria South east (Okpako 2014; Nzei 2015, Ejechi & Denyinfa 2012; Obaniku 2014, Ojo & Odi 2013). The perennial nature of *Teifera occidentalis* makes it susceptible to bioaccumation and biomagnification of contaminants in the soil and particulates through gas flaring (Ugbe & Ugbe; Ezenwakea 2012; Okafor and Ndili 2014; UFot & Usen 2011).

Uzere is an oil bearing community in the Niger-Delta with numerous oil well and gas flaring sites. (Ahon 2011, Utiwore 2013; Evroro 2016; Orise 2013). Numerous researches have been reported on the environmental impact of oil exploitation in the Niger-Delta, (Okara 2013; Dara & Ogheneakoke 2014, Hosfall & Clarke 2014, Briggs & Ogbara 2014, Major & Idoghor 2014). However research documentation on the impact of oil activities on Uzere remain barely available or at best scanty and this underpins this study.

The purpose of this study is to assess the heavy metals content of *T. occidentalis* grown in Uzere oil rich community for continued cultivation.

This study is guided by the following research questions.

1. What are the concentrations of Cu, Zn, Mn, Co and Cr in *T. occidentalis* grown in Uzere soil.
2. Are the concentrations of the heavy metals in the *T. occidentalis* grown in Uzere within the WHO maximum allowable concentrations for heavy metals in leafy vegetables?
3. Can schools and people of Uzere continue to cultivate and consume vegetables and other crops grown in their soil?

The study was guided by the hypothesis;

HO: There is no significant difference between the concentrations of heavy metals in the *T. occidentalis* grown in Uzere and WHO maximum allowable concentrations of the heavy metals in leafy vegetables

The research area

Figure 1: Map of Isoko showing Uzere
Source: Okpevra (2020)

Uzere is an oil producing community in Isoko South local Government area, Delta State, Nigeria It lies between the GPS 6°5'12"N and 6°10'E. Uzere people are agrarian with Cassava and groundnut as the major crops, they also engage in fishing and fish farming. (Okon2011; Dureme 2013; Okoro 2012; Elozino 2013). Uzere is one of the major host communities of oil companies in Delta State, it hosts two oil fields, Uzere west and Uzere East with 43 oil wells and numerous gas flare sites (Akiri 2014; Ejiro 2013; Enigheno 2012; Ekoko 2014, Opia 2015). It has a population of 45,350 (National Population Census 2006).

II. MATERIALS AND METHODS

The research area Uzere was mapped out into research stations corresponding to the quarters that make up the community. Uzere is made up of nine quarters. However 5 quarters were randomly sampled to constitute the research stations and these are Ulei, Tzede, Uwege, Uhroko and Iboro. From each of these research stations edible portions of *Teifera occidentalis* were sampled, bulked, composites, drawn, wrapped in absorbent paper, coded and taken to the laboratory for analysis.

At the laboratory, the samples were dried at 40^c to a constant weight. After cooling, 5g was washed out and 20ml aqua-regia (3Hcl: $1HNO_3$) was added and digested in a hot plate till final volume was 1ml. The solution was allowed to cool and filtered into 50ml standard flask and made up to mark with distilled water. Quantitative determination of heavy metals were carried out using an Agilent atomic absorption spectrophotometer model 240A equipped with air/acelylene burner.After digestion of the samples, hallow cathode lamps of metals of interest were used and background corrections were done using deuterium lamp. Working standard for instrument calibration was prepared from stock solution of 1000ppm for each metal by several dilution using double distilled water. Blank sample were also run to check for background contaminations.

III. RESULT

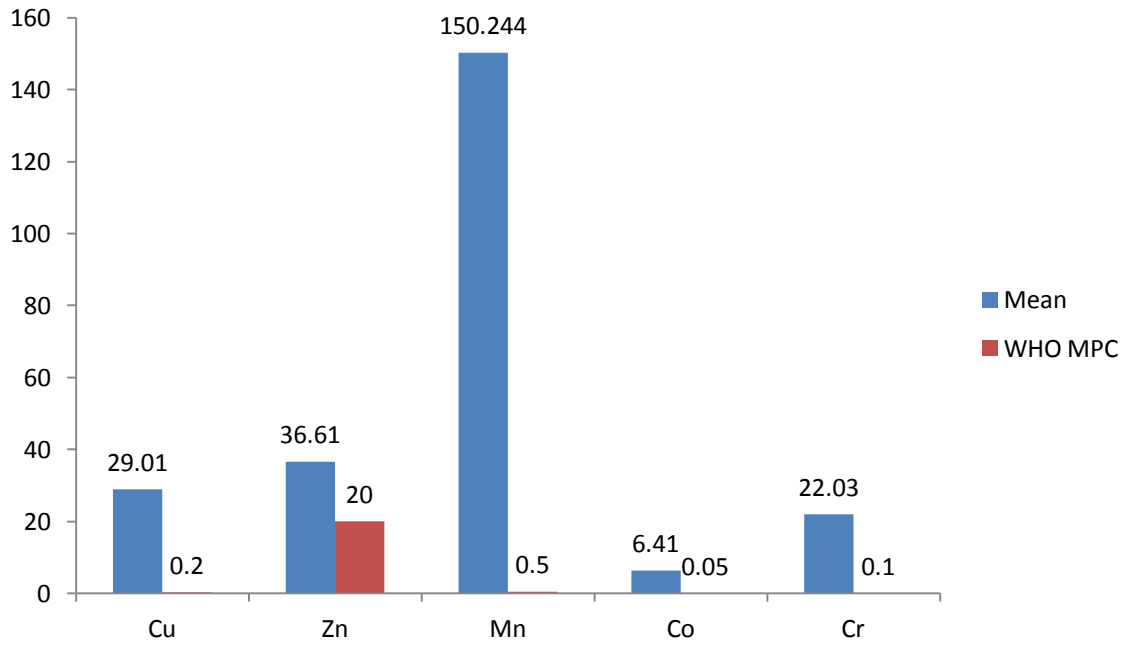
The results of the heavy metals analysis in *T. occidentalis* in Uzere are as in Table 1.

Table I Results of the heavy metals investigated in mg/kg and World Health Organization maximum permissible concentration (MPC).

Metals	**Concentrations**							
	A	B	C	D	E	$\bar{x}$	**Sd**	**WHO MPC**
Cu	29.04	28.92	29.06	28.01	28.97	29.01	0.067	0.20
Zn	36.48	36.72	36.55	36.60	36.69	36.61	0.09	20.00
Mn	150.00	150.04	150.60	150.80	150.08	150.244	0.28	0.5
Co	6.48	6.43	6.32	6.40	6.41	6.41	0.56	0.05
Cr	22.01	22.08	22.05	22.03	22.00	22.03	0.03	0.10

The mean concentrations of the metal investigated were presented graphically as in Figure 1.

Figure 1 The mean concentrations of the metals investigated.



The concentrations of the metals in descending order are as follows Mn>Zn>Cu>Cr>Co.
The concentrations of the metals investigated in *T. occidentalis* in Uzere were further subjected to test of significance deploying ANOVA with numerator 4 and denominator 20 at 0.05 level of significance. The F ratio, calculated value is 4.83 while F. ratio critical value is 2.87. Thus rejecting Ho. This means that there is significant difference between the concentrations of metals in *T. occidentalis* in Uzere and the WHO maximum allowable concentrations for the metals in leafy vegetables.

IV. DISCUSSIONS:

The results of the metals investigated were treated with statistical instruments of mean, and standard deviation and the results of the determinations revealed the following; the mean concentration of Cu is 31.01 ±4.51mg/kg. The WHO maximum allowable concentration for Cu in leafy vegetables is 0.20mg/kg. The concentration of Cu in *T. occidentalis* in Uzere in higher than recommended. High concentration of Cu in leafy vegetables have been reported (Alexander & Alloway, Dourando 2006; Al-Jassir shaker & Khaliq 2005). The mean concentration of Zn in *T. occidentalis* is 36.61± 0.09mg/kg. The WHO maximum allowable concentration for Zn is leafy vegetables is 20.00mg/kg. This is an elevated concentration. Increased concentration of Zn in leafy vegetables have been recorded (Qadir, Ghazoor & Muzaza 2000; Sharma, Agravoat & Marshall 2007). Mn mean concentration in the *T. occidentalis* in Uzere is 150.24 ± 0.28mg/kg. WHO maximum allowable concentration for Mg in leafy vegetable is 0.5mg/kg. The concentration of Mn is higher than the acceptable limit. High Mn content in leafy vegetables have been documented (Kachenko & Singh 2006; Ge, Murray & Hendershot 2000; Ge, Murray, Sause & Hendershot, 2002). Co mean concentration in the *T. occidentalis* in Uzere is 6.41±0.56mg/kg. The WHO maximum allowable concentration for Co in leafy vegetables is 0.05 mg/kg. Co concentration is higher than the acceptable limit. Higher concentration of Co in leafy vegetable was reported by (De-Muquel, Irribarren, Chacon & Ordonez 2010; Peris, Mico, Recataha, Sanchez & Sanchez, 2007). The mean Cr concentration in the vegetables investigated in Uzere is 22.03 ± 0.06mg /kg. WHO maximum allowable concentration of Co in leafy vegetables is 0.10mg/kg. Cr concentration is higher than maximum allowable concentration of Cr in leafy vegetables. Increased Cr in leafy vegetables have been documented (Negla, Barrhera, Boluda, Errecalde & Lagarda 2009; Sharma, Agrawal & Marshall 2009).

V. CONCLUSION:

Global quest for industrialization has subjected the environment to quantum degradation occasioned by effluents discharges and emissions. The wealth of a nation is positively correlated to the health of the nation. Industrialization in any form should be carried out with the set down rules and standards to reduce its effects on the environment. The result of this investigation has shown that Uzere environment has been degraded by contaminants. Uzere inhabitant's health should be seen as a priority, so the methods of oil extraction and emissions should be done with world best practice as checklist to reduce the effect on the environment – crops and animals.
Colorary to the results of the investigations, the study recommends the following:
The oil companies operating in Uzere should adopt better means of disposing their effluents. They should also make sure that incidents of equipment failures and pipe ruptures are checked to reduce input of petroleum into the environment.
Gas flaring should be discontinued rather gas gathering and commercialization should commence.
Cultivation of *T. occidentalis* and other crops and vegetables should hult until remediation is carried in the environment.

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