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Trace Element Analysis of Some Leafy and Non Leafy Vegetable Samples in Anam District of Aghamelum Anambra State of Nigeria

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ABSTRACT

The bioaccumulation of trace metals such as Cd^{2+}, Cr^{2+} Cu^{2+} and Co^{2+} metal ions from the environment by the following crops: Garden egg (Solanum), scent leaf (ocimum) alimenceness Irish potatoes (Ipomea batata) and Elephant grass (perineum purpumeum) in Anam Area of Anambra State of Nigeria were investigated .The concentrations of these metal ions in these crops were analyzed using UNICAM 919 Atomic Absorption Spectrophotometer (AAS). From the results, Cu showed the highest concentration level of all the other trace metals, analyzed. The concentration level of Cu in the roots of scent leaf, Irish potatoes, garden egg and Elephant grass in the order of ranking are 3.35 $\pm$ 0.30 (mg/g) 2.87$\pm$ 0.40 mg/g 0.77$\pm$ 0.10 (mg/g) and 0.80$^{\pm}$ 0.05 (mg/g) respectively. For the leaves of the forages the concentration of Cu are 3.40 $\pm$ 0.30 (mg/g) for Garden egg, 2.35 $\pm$ 0.30(mg/g) for Irish potatoes, 0.90 $\pm$ 0.80 (m/g) for scent leaf and 0.65$\pm$0.05 (mg/g) for elephant grass. The rest concentration for Cr, Co, and Cd in the root stems and leaves of the leafy and non leafy samples are carefully tabulated. Co showed the least concentration level of all the other trace metals. The trend of the concentrations of the trace metals can be put as Cu > Cr> Cd > Co. It was observed from the results that the leafy sample contains higher concentration of trace metals than their roots and stems, with Cu and Cr concentration levels being higher than those of Co and Cd in all samples. Hence this higher concentration imposes toxicity to the ecosystem through the food chain and as well results to physiological effects, though there are normal requirements in small quantities of these metals needed to improve the status of nutrition in humans and livestock.

Key words: *Leavfy And Non Leafy Vegetable, Heavy Metal, Food Chain, Garden Egg, Scent Leaf, Irish Potato and Elephant Grass.*

1. INRODUCTION

The increasing levels of environmental pollutions by toxic metals from various sources have generated a great concern on the impact on human health [1]. A large amount of these metals taken in by plants and animals subsequently find their way into the food chain [2]. This ever increasing pollution has given rise to concern on the intake of harmful metals in humans. Humans are prone to several routes of exposure and hence the need to evaluate the levels in human diet which is one of the easiest routes of exposure [3, 4,5,6,7,] Anam district of Anambra State is in the South Eastern State of Nigeria and is one of the areas of Nigeria where there is massive oil exploitation and exploration. The issue of oil pollution and environmental contamination in the Otuocha and its attendant consequences has been a serious matter that keeps attracting the attention of all and sundry. A lot of studies have been carried out in different parts of Otuocha to understand the physio-chemical and biological characteristics of the environment as well as the extent of pollution in the area [8, 9, 10,11] Trace elements or micro-nutrients are found only in minute quantities in the body, yet they are vitally important. Our diet consisting more of refined foods are causing concern that modern man is not receiving enough of these trace mineral in his food sources and dietary supplement may be of use in combating this shortage. Hence the interaction of these micro nutrients are difficult to study because they are found occurring together in various forms and amounts in the diet where each of their absorption from the intestinal track may be dependent on their relative concentrations, which might the synergetic or antagonistic hence the amount of nutrient to be taken will depend on the measure of other essential elements in the diet [12]. Early in human civilization grass lands were utilized by wandering animals and by people who used those animals for food and other products. These undisturbed grass lands because of the natural life and death cycle, over long periods of time, produced a deep fertile top soil [13]. These very fertile grass land area are still used today but often cultivated for production of major food crops like wheat and corn as well as for forages. Before human activity began to alter grass lands, they were naturally maintained as productive grass lands by favourable climate, grazing wild- life and natural fibers [14]. As civilization continued to improve, humans began a process of domesticating or training some of the wandering animals and more intensive management of livestock or forage lands, were developed. Gradually, a distinction evolved between the grass lands developed by man and that of natural grass lands. This distinction became very important in the study of the type of grass grown. [14]. Advancement in technology as well as increase in population have led to the environment concern relating from indiscriminate dumping of refuse and discharge of industrial effluents, petroleum waste water and crude oil spills replete with most common trace metals in our environments (15). Ggbaruko and Friday (16) reported that various activities by man in recent years have increased the quantity and distribution of heavy metals in the atmosphere, land and water bodies. The extent of these wide spread but diffused contamination has raised concern about their hazards on plants, animals and humans. The extent of the fate of metals introduced by human activities into the ecosystem have recently become the subject of wide spread concern since beyond the tolerable limits they become toxic (17, 18). Hence, the determination of harmful and toxic substances in the environment (ecosystem) gives direct information on the significance of pollution in such environments. Most of these studies provided general baseline information while some attempted to explain the possible effect of industrial discharge on this terrestrial and aquatic environment. Therefore, this study was aimed at finding the concentration levels of cadmium, chromium, copper and cobalt ie Cd^{2+} , Cr^{3+}, Cu^{2+} and Co^{3+} in four samples which includes garden egg, scent leaf, Irish potatoes and elephant grass found in Anam district of Aghamelum Anambra State Nigeria. The root, stem and leaf of the leafy and non- leafy samples were used. Therefore this research is of urgent need to control and monitor environmental degradation in the area. Thus, the study seeks to assess the impact of oil exploration and exploitation industry on trace contamination of these leafy and non-leafy samples which serves as edible food to man and livestock. Ocimum alimantete(scent leaf), ipomea batata(irish potatoes), solanum melogena(garden egg) and perimeum purpumeun (elephant grass) plants are cultivated as vegetables. The Ocimium alimenance (scent leaf) and solanum melogena (garden egg) tender leaves are used for preparation of delicacies. The roots of Ipomea batatas (Irish potatoes grows into tubers which is a good sources of carbohydrate while leaves of perineum purpumeum (elephant grass) and the leaves of all the leafy and non leafy selected are used in livestock for animal.

2. MATERIAL AND METHODS

All reagents used were of analytical grade purchased and used without further purification, fine powder of the leafy and non leafy samples were used. All solutions / dilutions were made with distilled water.

SAMPLE COLLECTION:

The samples (scent leaf, garden egg, Irish potatoes and elephant grass) were selected from a vegetable area in Anam Zone of Agbameum. On collection, the samples were washed under tap water and then distilled water, put in cellophane bags and transported to the laboratory of pure and industrial chemistry Department, Anambra State University, Uli, Nigeria. The plant samples were properly identified at the Department of Biological Science, Anambra State University Uli, Nigeria.

SAMPLE PREPARATION:

Young fruitless solanum melerona plants were uprooted with the tender plants of Ocimum alimencen, Ipomen batata (tuberless) and pennisetu mpurpumeum with their fresh leaves were uprooted washed with tap water to remove sand, dirt and then rinsed thoroughly with distilled water. Stainless steel knife was used to cut the plant parts into leaves, stems and roots. The separate plant parts were dried to constant weight in an oven at 105^{o}c. They were pulverized to fine power using a laboratory mill (grinder). The samples were again dried in an oven at 105^{o}c, and then stored in desiccators for further use.

CHEMICAL ANALYSIS:

Each samples (2g) was accurately weighed into clean platinum crucible, ashed at 450-500^{o}c for12hrs and then cooled to room temperature in a desiccators. The ashed sample was dissolved in 5ml 20%, HCL and the solution carefully transferred into a 100ml volumetric flasks. The crucible was well rinsed with distilled water and transferred to the volumetric flash and then was made up to the mark with distilled water. The flask was thoroughly shaken to mix well. The samples were then analyzed for trace metals in triplicates using Atomic Absorption spectrophotometer (AAS) UNICAM919 Model in accordance with standard methods (19)

STATISTICAL ANALYSIS:

Mean and standard deviation of samples were calculated and reported. Also data obtained were analyzed, using the one way analysis of variance (ANOVA) and group means were compared using Duncan's multiple range test at P values < 0.05 level of significance.

3. RESULTS AND DISCUSSIONS

The differences in concentration for the trace elements in the leafy and non leafy plant parts are presented below. Figure 1 shows the levels of the trace element in root, stem and leaf of Garden Egg (Solamum Melogena). From these figures, the following observation could be made. Cu had the highest concentration of all the other elements analyzed with the concentrations of 0.77$\pm$ 0.10, 1.5 $\pm$ 0.20 and 3.40 $\pm$ 0.30 (mg/g) for the root, stem and leaves of garden egg, hence the garden egg leave show the highest concentration level of Cu and of other element amongst the plant parts. Cr concentration level follows after Cu, with the concentration of 0.33 $\pm$0.04, 0.73 $\pm$0.04 and 0.78 $\pm$ 0.04 (mg/g) for the roots, stems and leaf of garden egg plant. Next is Cd concentration level with the values 0.24$\pm$ 0.04, 0.33$\pm$ 0.01 and 0.84$\pm$ 0.02 (mg/g) for root, stem and leaf of garden egg respectively. Co gives result for root, stem and leaf as follows 0.22$\pm$ 0.04, 0.2$\pm$0.01, 0.25$\pm$0.02.

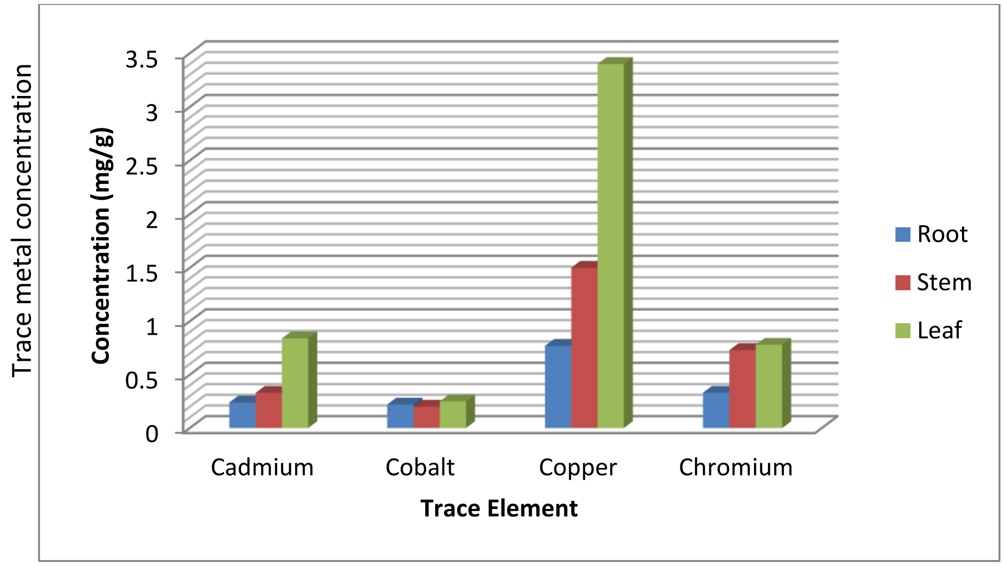

Figure 1: Trance metal levels in root, stem and leaf of Garden egg (solanum melogela)

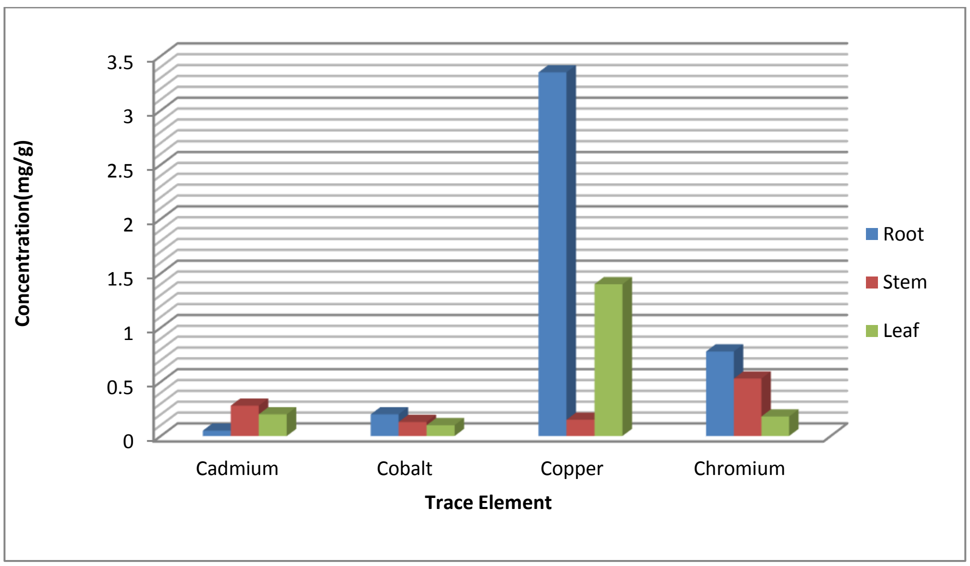

Figure 2: Trace metal levels in root, stem and leaf of scent leaf (Ocimum menenss)

In scent leaf, Cu showed the highest level of concentration in the root with a value of 3.35 ± 0.30 (mg/g), while the concentrations for stem and leaf are 0.15 ±0.01 (mg/g) and 1.40±0.08(mg/g) respectively. Cr had concentration of 0.78± 0.05 (mg/g), 0.53± 0.04(mg/g), 0.18± 0.02(mg/g); Co had 0.20± 0.07(mg/g), 0.13 ± 0.03 (mg/g), and 0.10 ± 0.02 (mg/g) and Cd had 0.05 ±0.08 (mg/g), 0.28 to 0.01 (mg/g), 0.20 ± 0.03 (mg/g), for the root, stem and leaf of scent respectively. The root of scent leaf had the highest concentration of the trace metals analyzed. In Irish potatoes, the root also showed the highest concentration level of trace elements. Cu had the highest concentration level with values of 3.85± 0.40, 2.30± 0.09 and 2.40± 0.30(mg/g). This is shown in figure 3. For elephant grass, the root also showed the highest concentration level of Cu still maintained. The highest level of concentration with values of 0.80 ± 0.05 (mg/g), 0.75± 0.04(mg/g) and 0.65± 0.05(mg/g), for the root, stem and leaf respectively. This is shown in figure 4. Generally, the concentrations of the trace elements are slightly lower in leaves compared to those of the root and stem which is not statistically significant at ($p< 0.05$) level of significance. Plant uptake of heavy metals depends significantly on the metal as well as soil conditions such as acidity and organic matter content. Similarly, metal amounts in different soils can be harmful in one and harmless in another [20].

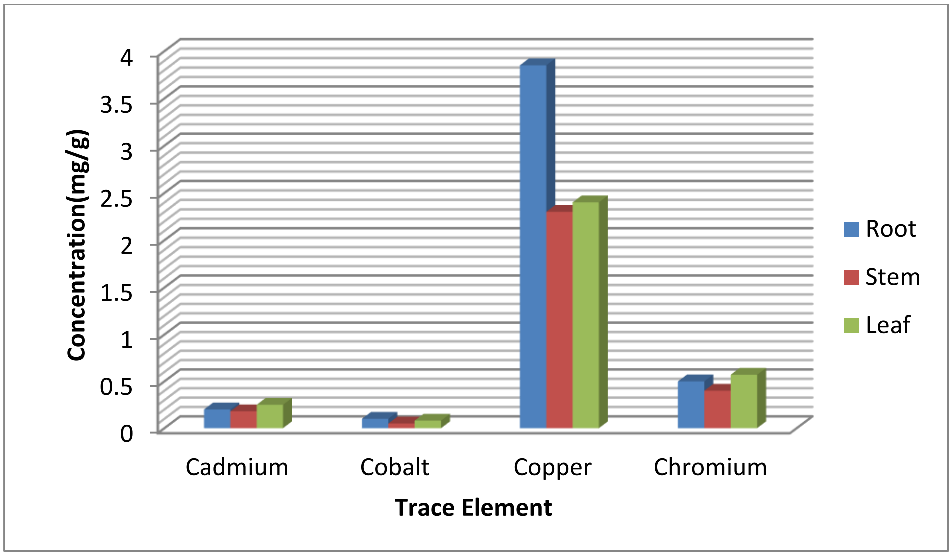

Figure 3: Trace metal levels in root, stem and leaf of Irish potatoes (Ipomea babata).

Several studies have indicated that crops grown on heavy metal contaminated soils have higher concentration of heavy metals than those grown in uncontaminated soil [21]. Also, vegetable are reported to take up heavy metals from aerial deposits on the above ground parts of the vegetables that are exposed to polluted air [22]. The levels of the trace metals found in the parts of the leafy and non-leafy samples were quite high. These could be as a result of anthropogenic addition through industrial discharge and emission in the area.

There has been growing concern about the physiological, biochemical and behavioural effects of environmental trace metals in human population. The impacts of pollution on the environmental have been categorized into three groups; biological agents, chemical and physical hazards [23, 24]. The chemical hazard which includes the trace metals in human population. The chemical hazard which includes the trace metals accumulates over time hence the higher level obtained and then shows toxicity.

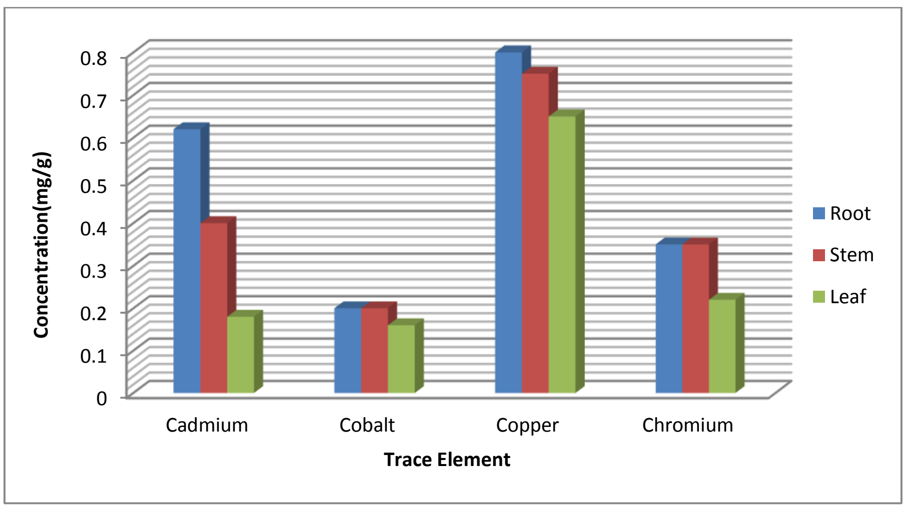

Figure 4: Trace metals levels in root, stem and leaf of Elephant grass (Pennisetum purpureum)

Table 1 shows the adverse effect of some trace metals and the organ or area mostly affected (25). For examples, chromium has been reported to reduce cognitive development and intellectual performance in children, increased blood pressure and cardiovascular disease in adult as well as liver and kidney dysfunction [26] and the Nigeria Guardian newspaper 26/11/2009, [27]. Hence the presence of these metals high levels suggests that there are toxicological risks in the consumption of these plant crops.

Table 1: adverse effects of some metals

Organ/Area	Trace Metal	Broad health effects
Central nervous system	Cr	Reduced neuropsychological function
Renal system	Cd	Tubular nephritis and dysfunction
Blood system	Cr	Inhibits biosynthesis of heam
	Cd	Slight anemia

4. CONCLUSION

The high level of these trace metals in the crop samples investigated gives cause for concern. Anam district of Aghamelu experiences heavy oil exploration and exploitation with its attendant consequences such as individual pollution, Oil spillage, Gas flaring and so on. Therefore, the concern of today is the possibility that conditional exposure by the use of the analysed samples as sources of carbohydrate and soup making may result to gradual accumulation of these metals in the human system and may lead to adverse public health effects.

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