

HEAVY METAL CONTAMINATION IN CULTIVATED SOIL BY PUMPKIN VEGETABLE IRRIGATED WITH WASTEWATER

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ABSTRACT

The aim of this Study to determine the heavy metals in cultivated soil and pumpkin vegetable from claiques creek south Kenana town and its effect on consumers. The samples were analyzed by using atomic absorption spectrometry (AAs model AA 6200) Japan. Samples of cultivated soil and pumpkin fruits collected from different locations were irrigated with wastewater came from Cane farms surpluses water to determine the elements namely (Cu^{+2} , Zn^{+2} , Pb and Cd^{+2}). The results of cultivated soil were recorded as follows: Cu^{+2} 1.200 mg/kg to 1.600 mg/kg; (0.0006 mg/kg) Zn^{+2} 0.400 mg/kg to 0.600 mg/kg; (0.002 mg/kg) and Pb^{+2} 1.40 mg/kg to 2.20 mg/kg; (0.0002 mg/kg) the cadmium element undetected in cultivated soil sample. the result of pumpkin vegetable were recorded as follows: Cu^{+2} 0.045 mg/kg to 0.047 mg/kg; (0.0006 mg/kg) Zn^{+2} 0.24 mg/kg to 0.25 mg/kg; (0.002 mg/kg) and Pb^{+2} 0.11 mg/kg to 0.12 mg/kg; (0.0002 mg/kg). The cadmium element also undetected in Pumpkin fruits vegetable. According to the international standards (values between brackets) that were taken from WHO and FAO. Obviously, the Concentration of Cu^{+2} , Zn^{+2} and Pb^{+2} both in cultivated soil and pumpkin fruits vegetables were higher than international standards. Hence, the Contamination which was observed impermissible ranges of these heavy metals. Conclusively, the wastewater effluent in Claiques Creek and cultivated soil directly caused significant contamination in this area. Generally, high accumulate amount of heavy metals leads to contamination of food chain acts as a primary route for the entry of heavy metals into animal and human tissues, making them prone to several variably diseases. The study recommends treatment of wastewater then put into consideration before reaches the White Nile River and Claiques Creek, after that it should be used for agriculture purposes and breeding livestock.

KEYWORDS: Heavy metals, WasteWater, WHO, Vegetables.

INTRODUCTION

As consequence of industrialization during the last centuries, the heavy metals concentration of soil has

increased worldwide (Adriano, 2001). hot spots of soil concentration are located in area of large industrial activities, where surround agricultural areas are effected

by a atmospheric deposition of heavy metals. also agricultural practice, e.g application of sewage sludge or phosphate for fertilizers has lead to increased. Metal concentration in soils. also increasingly economic growth and technological development is evident in modern times but has brought about numerous environmental problems causes by residues derived from industrial processes. heavy metals when applied to the soil can accumulate and persist for long periods of time. these element can be phototoxic and harmful to vital micro bail processes in nutrient cycling (yadav 2010). heavy metal are among the most common chemical constituents in soil that are associated with human activities (Rodriguez martin *etal*, 2015); tahmashian *etal*; 2013). some of these potentially harmful elements such as Zinc (Zn) Copper (Cu) Manganese (Mn) Chromium (Cr) Nickel (Ni) and cobalt (Co) are known as essential trace metals because they are required only in minute amount by living organisms for normal growth or in small concentration are essential nutrients for plant growth but excessive concentration of most trace elements may have toxic effect, while other metals such as lead (pb) arsenic (As) and cadmium (Cd) are toxic even at low concentration (kelepertzie and argrari, 2015) bioavailability at heavy metals in soil is critically, dependent on the chemical specialization of the metals and plants respond only to the metals and plant respond only to the fraction that are plants have mechanisms of tolerance to high concentration of heavy metals.

Samples Preparation

Sub samples (each of 500g) were taken at random from the composite samples (200g) were processed for analysis be the dry. aching method. The samples were first oven –dried at 105°C for 24hours. The dried samples were then powdered manually a grinder and were subjected to analysis for their heavy contend. powdered samples (14g each), with three replicate taken for each food item, were accurately weighted and placed in a silica crucible, Few drops of concentrated nitric acid was added to the solid as an aid to aching. (John wiley, 2007).

The dry-aching process was carried out in muffle furnace by stepwise increase of temperature up to 550°C and the sample left to ash at this temperature for 6hours the ash was kept in desiccators and then rinsed with 3N hydrochloric acid.

The ash suspension was filtered into 50ml volumetric flask through Whatman NO. (1) Filter paper, and the volume was made up to mark with 3N hydrochloric acid (Sobukola *etal*, 2010).

Determination of heavy metals

These heavy metals namely (Pb, Cd, Zn, and Cu) determination was performed by using Atomic Absorption Spectrometry (180-30 Hitachi Spectrometer).

The Limit of Detection (LOD) of the analytical method

for each metal was calculated as being triple the standard –deviation of a series of measurement for each solution (Sobukola *etal*, 2010).

Determination of metals in soil sample

Metals (mineral metals and heavy metals) were measured by (AAS model AA6200) Japan.

Procedure

- 1- 5g for each soil was weighed and placed into kjeldahls apparatus. Strong acid used nitric acid 8ml and 2ml concentrated per chloric acid. The mixture was heated to (50°C-190°C) step by step until the completely dry – (Mohammed. 2012)
- 2- Samples were cooled 10ml of 5% HNO₃ was added to each of sample and heated at 70°C for (one hour) with occasional mixing.
- 3- The mixture was then decanted, centrifuge at 3500 rpm for 10min.
- 4- 5g of an air dried-ground were- placed and the sample was sieved in an Erlenmeyer flask.
- 5- 20ml of extracting solution were added (0.05M HCL + 0.05 H₂SO₄).
- 6- The solution was placed in mechanical shaker for 15min.
- 7- It was] filtered through what man 42 filter paper into 50ml volumetric flask and it was diluted to 50ml with extracting solution (Mohammed. 2012).

Sample Analysis

Total Metals (Mineral and Heavy Metals) concentrations were measured using (AAS) Shimadzul (Model AA6200) Japan double beam.

Statistical analysis

Statistical analysis of data was carried out using RCBD (Randomized Complete Block Design) programs. A one way analysis of variance (ANOVA) was performed. Differences in mean values were accepted as being statistically significant if $P < 0.05$. (lyman.R, 1993)

RESULTS

The results of heavy metals in cultivated Soil samples in (A) farm are shown in table (1) and table (2) below. The concentration of Copper in the samples were obtained in range of 1.200 mg/ kg to 1.600 mg / kg the levels were not acceptable limits recommended by the FAO i.e. (0.0006mg/kg), the concentration of Zinc in the samples were obtained in the range of 0.400 mg/kg to 0.600 mg/kg the levels were not acceptable limits prescribed by the FAO i.e. (0.002mg/kg), the concentration of lead in the samples were obtained in range of 1.40 mg / kg to 2.20 mg/kg the levels were also not acceptable limits recommended by the FAO i.e. (0.0002mg/kg) and the results were indicate that the concentration of Cadmium was insignificant due to Cadmium was undetected.

Table of Mean (1) in farm (A) of heavy metals (Cu, Zn, Pb and Cd) in cultivated Soil.

Replications	Treatments			
	Cu mg/kg	Zn mg/kg	Pb mg/kg	Cd mg/kg
R1	1.600	0.600	1.40	0.00
R2	1.200	0.600	2.00	0.00
R3	1.400	0.400	2.20	0.00
Total (T)	4.200	1.600	5.60	0.00
Mean ($\bar{x}$)	1.400	0.533	1.86	0.00
Reference value	0.0006	0.002	0.0002	0.0005

The ANOVA Table (2) in location (A) of heavy metals (Cu, Zn, Pb and Cd) in cultivated Soil.

Source of Variation	Degree of freedom	Sum of Square (SS)	Mean of Square (MS)	F. value	Tabular (F) value	
					5%	1%
Treatment	3	0.101077	0.0337	3063.63	3.49	5.95
Experimental error	12	0.000136	0.000011			
Total	15	0.101213				

** highly significant at (1%) level significance

The results of heavy metals in pumpkin samples in (B) farm are shown in table (3) and table (4) below. The concentration of Copper in the samples were obtained in range of 0.045 mg / kg to 0.047 mg / kg the levels were not acceptable limits recommended by the FAO i.e. (0.0006mg/kg), the concentration of Zinc in the samples were obtained in the range of 0.24 mg/kg to 0.25 mg/kg

the levels were not acceptable limits prescribed by the FAO i.e. (0.002mg/kg), the concentration of lead in the samples were obtained in range of 0.11 mg / kg to 0.12 mg/kg the levels were also not acceptable limits recommended by the FAO i.e. (0.0002mg/kg) and the results were indicate that the concentration of Cadmium was insignificant due to Cadmium was undetected.

Table of Mean (3) in farm (B) of heavy metals (Cu, Zn, Pb and Cd) in pumpkin Sample.

Replications	Treatments			
	Cu mg/kg	Zn mg/kg	Pb mg/kg	Cd mg/kg
R1	0.047	0.24	0.12	0.00
R2	0.054	0.24	0.12	0.00
R3	0.047	0.25	0.11	0.00
Total (T)	0.139	0.73	0.35	0.00
Mean ($\bar{x}$)	0.046	0.24	0.12	0.00
Reference value	0.0006	0.002	0.0002	0.0005

The ANOVA Table (4) in location (B) of heavy metals (Cu, Zn, Pb and Cd) in pumpkin Sample

Source of Variation	Degree of freedom	Sum of Square (SS)	Mean of Square (MS)	F. value	Tabular (F) value	
					5%	1%
Treatment	3	0.101077	0.0337	3063.63	3.49	5.95
Experimental error	12	0.000136	0.000011			
Total	15	0.101213				

** highly significant at (1%) level significance

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