



SINCE 2013

NAAS SCORE : 4.32  
(2017 to 2020)

SJIF 2020 = 6.618,  
2021: 6.95, 2022:  
7.128

IPI Value 2019: 1.90

2020: 1.90; 2021:  
2.53; 2022-23: 2.59.

CiteFactor Impact  
Factor 2020-21:0.57

Academic Resource  
Index 2020:10

Received on:

23<sup>rd</sup> November 2023

Revised on:

24<sup>th</sup> November 2023

Accepted on:

16<sup>th</sup> December 2023

Published on:

1<sup>st</sup> January 2024

Volume No.

Online & Print

41

Page No.

07 to 12

*IRJC is an international open access print & online journal, peer reviewed, worldwide abstract listed, published quarterly with ISSN, Free-membership, downloads and access.*

**DETERMINATION OF HEAVY METALS IN SOIL OF FARIN GADA  
VEGETABLE FARM JOS NORTH LOCAL GOVERNMENT, PLATEAU  
STATE, NIGERIA**

**SHITTU ABUBAKAR MUHAMMAD<sup>1</sup>, ANSAR BILYAMIN ADAM<sup>2</sup>,  
SHAMSU ABDULLAHI IDRIS<sup>3</sup>, ABUBAKAR AMINU<sup>4</sup>,  
ABDULLAHI JABIR ABUBAKAR<sup>5</sup> AND  
NASIRU ADO MUHAMMAD<sup>6</sup>**

**DEPARTMENT OF CHEMISTRY, UNIVERSITY OF JOS<sup>1,5</sup>**

**DEPARTMENT OF CHEMICAL SCIENCE, FEDERAL UNIVERSITY  
WUKARI<sup>2</sup>,**

**FEDERAL COLLEGE OF EDUCATION ODOUGBO <sup>3</sup>**

**DEPARTMENT OF PURE AND INDUSTRIAL CHEMISTRY,  
NNAMDI AZIKIWE UNIVERSITY, AWKA<sup>4</sup>**

**DEPARTMENT OF CHEMISTRY, FEDERAL UNIVERSITY LOKOJA<sup>4</sup>**

**DEPARTMENT OF PURE AND INDUSTRIAL CHEMISTRY,  
BAYERO UNIVERSITY, KANO<sup>6</sup>.**

**E-mail: [ansarbilyamin@gmail.com](mailto:ansarbilyamin@gmail.com)**

**ABSTRACT:**

Heavy metals are essential metals which are very important to the soil, their accumulation in high concentration more than the required amount causes a health risk as it may have transferred from the soil to the plants. This study investigates the presence of some heavy metals in three sample of the soils at Farin Gada farm. The metals determined were zinc, cadmium, copper, arsenic, lead and chromium, the result showed that the amount of heavy metals found in the soil sample are within the permissible limit recommended by WHO, and hence the soils are good for the production.

**KEYWORDS:** Zinc, Cadmium, Copper, Arsenic, Lead, Chromium.

### **INTRODUCTION:**

Soil is normally considered as the fine earth which covers land surfaces as a result of the in-situ weathering of rock materials or the accumulation of mineral matter transported by water, wind, or ice. The distinctive feature of soil is that to this weathered mineral material is added organic material. This organic material may be both living and dead. The dead organic matter will include little altered and freshly added dead plant roots and leaf and other plant litter, dead fauna, and organic material in various stages of decomposition from little modified relatively fresh materials to the complex decomposed material called humus. It is this mixture of mineral and organic material which gives the soils their distinctive characteristics. Across the surface of the earth there are many different types of soil which reflect, at least in part, varying combinations of mineral and organic matter and their differing responses—both separately and often in complex association—to different environmental conditions. Indeed soil (and the soil constituents), together with the plant life it supports, the rock on which it lies, and the climate it experiences, forms a finely balanced system. Soil is essential for many human activities. It is also a basic part of the natural environment. The development of humans and society since prehistoric times has been closely linked with an increasing ability to manage the soil to human benefit. This progress has been achieved by adjusting the balance between the soil and its natural environment. These adjustments have not always resulted in positive responses and benefits, and there are records throughout history describing soil destruction as a result of mismanagement and misuse of the soil, often as a result of the failure to understand the nature and complex of the soil environment relationships. (Stephen *et al*, 2017)

Soil is very important to human being; soil contamination affect not only crop production but also affect human being indirectly through the cultivated crops. Heavy metals are those elements that have relatively high density and are poisonous even at low concentrations. Industrial influence is one of the problems facing most of our rivers and water bodies. During irrigation farming, some of the heavy metals that are toxic to plants as well as a human health are used spatially in water that has a linkage with industries and urban areas. (Shittu, 2015).

## ***MATERIALS AND METHODS:***

### ***Materials***

Distilled water, nitric acid (HNO<sub>3</sub>), hydrochloric acids (HCl), (sigma Aldrich). All reagents were used as received.

### ***Sampling Area***

The Farin Gada vegetable garden is located at Jos North Local Government, Plateau State. The vegetable garden is situated along the river band that is sourced from river Dilimi. The river is used for irrigating the planted crops and vegetables in the garden. The vegetable produced at Farin Gada vegetable garden is one of the largest and best vegetables in Plateau state and Nigeria at large. Jos – North local government is located at the extreme north of Plateau State on Latitudes 09° 53' and 09° 59' North, and Longitudes 08° 51' and 09° 02' East. It shares a boundary to the North with Toro Local Government Area of Bauchi State; to the South with Jos-South Local Government area; to the North-East with Jos-East Local Government Area; and to the West with Bassa Local Government Area. Jos-North Local Government enjoys a temperate climate with average temperatures of between 28°C (81.7°F) maximum and 11°C (51.7°F) minimum. It covers a total land area of 291 km<sup>2</sup> (112 sq mi) with the 2006 provisional population census figure of 429,300 people. The warmest temperatures usually occur in the dry season months of March and April. Similarly, Jos-North Local Government is characterized by a mean annual rainfall of between 1317.5mm (131.75cm) and 1460.00mm (146.0cm), mostly from May to August. The Onset and Cessation of rainfall in Jos-North are experienced in April (±15 days in April), and October (±15 days in October) respectively. The relative humidity is characterized by a marked seasonal variation. (Shittu, *et al*, 2023)

### ***Collection of Samples***

Three soils from three different locations were obtained from farms within the Farin gada vegetable Garden. The samples were spread in for air drying at room temperature.



**Figure 1: S1, S2 and S3**

### **Digestion of sample**

2.5g of the soil sample were transferred into a crucible before being mixed with 10ml of aqua regia with consistent of HCl: HNO<sub>3</sub> (3:1). The mixture was then digested on a hot plate a95°C for one hour and was allowed to cool to room temperature. The sample was then diluted with to 50ml using deionized distilled water and was left to settled overnight. The supernatant was filtered through Whatmann No 42 filter paper. (Ramesh, 2016)

### **Determination of Heavy Metal in soil (S1, S2, S3)**

The heavy metals of the vegetable were determined using Microwave Plasma Atomic Electron Spectroscopy (MPAES).

**RESULT S:**

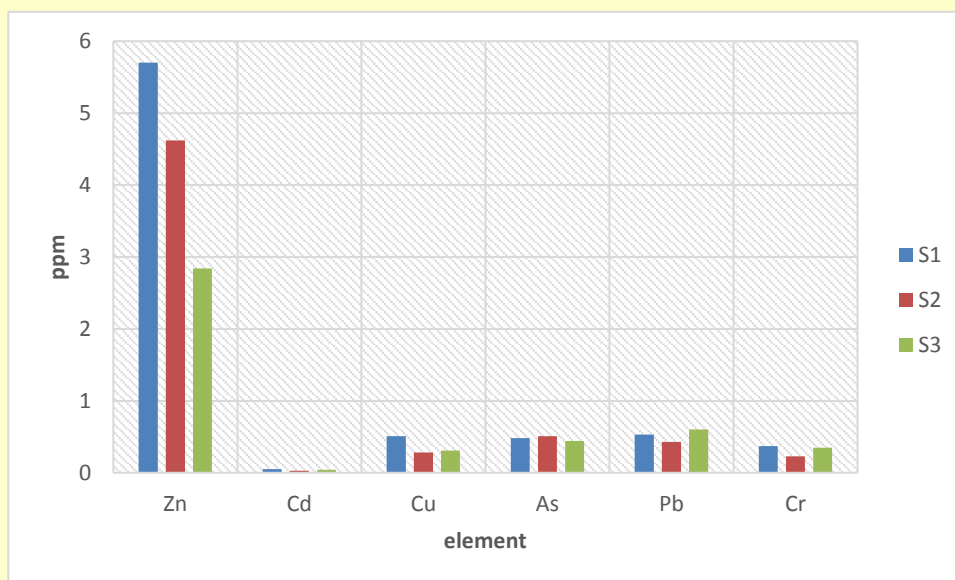
**Table 1: Heavy Metal Content of Soil Samples at Farin gada Vegetable farm (mg/kg)**

Sample	Zn	Cd	Cu	As	Pb	Cr
S1	5.70±0.02	0.05±0.00	0.51±0.00	0.48±0.04	0.53±0.00	0.37±0.00
S2	4.62±1.32	0.03±0.00	0.28±0.00	0.51±0.06	0.43±0.00	0.23±0.00
S3	2.84±0.33	0.04±0.00	0.31±0.00	0.44±0.06	0.60±0.00	0.35±0.00
WHO	50.00 <sup>d</sup>	0.90-3.0 <sup>a</sup>	0.400 <sup>b</sup>	20.00 <sup>a</sup>	30-50 <sup>a</sup>	100.00 <sup>c</sup>

Standards (mg/kg)

**Key:**

**S1= Soil from Farm One, S2 = Soil from Farm two, S3 = Soil from Farm Three, WHO = World Health organisation, b = FAO/WHO (2015), and Commission Regulation (EU) 2015/100, b = Adu et al. (2012), = . WHO (1996), d= Ogundele DT, Adio AA, Oludele OE (2015)**



**Figure 2: Metal Concentration of Farin gada soil of the farms**

### **DISCUSSION:**

The Metal Content Analysis shows that the soil contains zinc (Zn) ranges from  $2.84 \pm 0.33$  to  $5.70 \pm 0.02$ , cadmium(Cd) ranges from  $0.03 \pm 0.00$  to  $0.05 \pm 0.00$ , copper(Cu) from  $0.28 \pm 0.00$  to  $0.51 \pm 0.00$ , Arsenic (As) from  $0.44 \pm 0.06$  to  $0.51 \pm 0.06$ , Lead(Pb) from  $0.43 \pm 0.00$  to  $0.60 \pm 0.00$  and chromium(Cr) from  $0.23 \pm 0.00$  to  $0.37 \pm 0.00$ . the study showed that the amount of heavy metals found in the soil sample are within the permissible limit of metal in the soil and hence the soils are good for the production.

### **REFERENCES:**

- Shittu, A. M., Ansar, B. A., Ushie, O. A., Ahmad, K. B., Abdullahi, J. A., & Nasir, A. M. (2023). Phytochemical Screening of Lettuce, Spring onion and Spinach cultivated at Farin Gada Farm Land. *TROPICAL JOURNAL OF ENGINEERING, SCIENCE AND TECHNOLOGY*, 2(1), 45–48.
- Shittu Abubakar Muhammad. (2015). Determination of Chromium Manganese and Lead in cabbage, lettuce and carrot harvested in Jos North Local Government Using Atomic Absorption Spectroscopy submitted to the Department of Chemistry, Kano University of Science and Technology, in partial fulfilment of the requirement for the award of Degree of Bachelor of Science. Pp 13.
- Stephen Nortcliff, Herwig Hulpke, Claus G. Bannick, Konstantin Terytze, Gerhard Knoop, Michael Bredemeier, Hubert Schulte-Bisping,(2017) *Soil*, 1. Definition, Function, and Utilization of Soil. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim  
Articl DOI: 10.1002/14356007.b07\_613.pub3
- Ramesh A, (2016): Herbal Medicines have long been used as a traditional mode of therapy for various aliment in india. *Journal of Medical sciences*. 13(1): 234-246 ncbi.nlm.nih.gov
- FAO/WHO; 2015 Codex Alimentarius. Codex general standard for contaminants and toxins in food and feed - CODEX STAN 193-1995. Joint p.59. Available:.13140/RG.2.1.4910.2560
- WHO (1996). Permissible limits of heavy metals in soil and plants (Geneva: World Health Organization), Switzerland. Slancheva, M. (1997). Investigated the effects of three fertilizer rates and two nitrogens sources (ammonium nitrate or urea) on growth and plant nutrition of lettuce in green house. *Bulgarian Journal of Agriculture Science* 3(2): 77-81
- Adu AA, Aderinola OJ, Kusemiju V (2012). Heavy metals concentration in Garden lettuce (*Lactuca Sativa L.*) grown along Badagry expressway, Lagos, Transnat. *Journal of Science and Technology*, 2(7):115-130.
- Ogundele, D.T., Adio, A.A., & Oludele O.E. (2015). Heavy Metal Concentrations in Plants and Soil along Heavy Traffic Roads in North Central Nigeria. *Journal of Environmental Analysis and Toxicology* 5: 334. doi:10.4172/2161- 0525.1000334.