Assessment of Heavy Metals in NPK-Treated and Untreated Sugarcane Juice Cultivated in Papalanto, Ogun State, Nigeria

Afolayan Olubisola Arike[1], Olanrewaju Mary Anuoluwapo[1], Kayode Omowumi Titilola[2] and Kayode Azeez Abideen Abolanle[3]*

[1]*Department of Science Laboratory Technology, Federal Polytechnic Ilaro, P.M.B 50, Ilaro, Ogun State, Nigeria*
[2]*Department of Biochemistry, Landmark University, P.M.B 1001, Omu Aran, Kwara State, Nigeria*
[3]*Phytomedicine Research, Drug Discovery and Development Laboratory, Department of Biochemistry, Benjamin S. Carson (Snr) School of Medicine, Babcock University, Ilishan-Remo, Ogun State Nigeria*
**Corresponding author*

***Abstract*:- There is a lot of public health concern about food contaminated with heavy metals. Most of human exposure to harmful heavy metals is via intake of contaminated food.In this research work, the NPK-treated (fertilizers added) and untreated (no fertilizers added) sugarcane samples were collected from major farms in Papalanto, Ogun State, Nigeria. The result clearly shows that both samples contain some heavy metals such as lead, copper and cobalt. The levels of lead and copper were higher in the NPK-treated sugar cane while cobalt level was higher in the untreated sugar cane.**

***Keywords*: Sugar cane,heavy metals, lead, copper, cobalt**

Abbreviations: NPK- N=Nitrogen, P=Phosphorus, K=Potassium

I. INTRODUCTION

Heavy metals contamination has become an interesting area of research to the scientific community because of their toxic effects to human beings. Heavy metals are those elements whose interactions with biological systems are determined by their Lewis acid and ionic indices properties. This narrows down to most of the transitional elements, rare earth elements and some p-group elements (Nogueira*et al.,* 2013). Plants constantly absorb heavy metals and their concentrations within the organisms could build-up to levels higher than those in the surrounding environment (Gebrekidan *et al.,* 2013, Nogueira *et al.,* 2013).

Even though some metalsare considered essential, they are harmful to human health when present at elevated amounts. Zn and Cu are needed for biochemical and physiological functions to maintain health. Their deficiencies lead to immunological defects and various abnormalities. Cu is a constituent of several enzymes and hence contributes to collagen synthesis and is important in the formation of nerves, connective tissues and the immune system. Zn plays a vital role in the normal functioning of biological systems such as transport of proteins, enzymes structure and functions, hormonal activities and specific receptor locations. However, the excessive concentration of Cu and Zn in food and foodstuff is known to have toxic effects on man and animals. Cu is known to cause irritation to the mouth, nose and eyes and also dizziness, headaches, stomach aches and severe gastrointestinal problems. It is also associated with liver damage when in excess, while high amounts of Zn can lead to reduction of immune function and levels of high-density lipoproteins(Wang, *et al*., 2012).

Sugarcane (*Saccharumofficinarum*) is of great economic importance. It is the highest-ranking crop worldwide with a yearly production in excess of 1.59 billion tonnes(Collin and Doelsch, 2010). It is the main raw material for production of sucrose, molasses and bio ethanol. Despite it obvious usefulness, very few studies have examined the presence of heavy metals in sugarcane. Although, billions of people consume the plant and its products, there is not enough information on the heavy metals accumulation by the plant and its adverseeffect on human's health. A number of studies have found out that sugarcane has the ability to absorb and retain heavy metals in significant amounts. For instance, a study by Abdulsalam*et al.,* (2008) in Nigeria reported that sugarcane has the ability to bio accumulate heavy metals and therefore posed health risk to humans. The study found out that even though the concentrations of Pb and Cd were not detected (below the detection limit of AAS) in irrigation water, the elements were detected in sugarcane juice cultivated in the same area. Some sugarcane varieties have been observed to have relatively lower abilities for uptake and retaining of heavy metal in their biomass. Wang *et al*., (2012) worked on some sugar cane varieties and reported that a sugarcane variety had comparatively lower heavy metals accumulation in contrast to six other varieties investigated in the study. They also found out that there was no significant correlation between concentration of heavy metal in sugar cane juice and soil's heavy metal concentration. They suggested that the level of heavy metals in the cane's juice is influenced relative by the ability of the cane to enrich the metals. This finding was similar to that of Collin and Doelsch, (2010) who reported that there was no correlation between total heavy metal concentration in soil and subsequent heavy metal levels in juice. Sugarcane is an outstanding biomass producer and is known to be tolerant to heavy metals. In an investigation by Zhang *et al.,* (2014), soil was induced with Cu (60–125 mg/kg), Zn (150–300 mg/kg) and Pb (500–1000 mg/kg). Studies have shown uneven distributions of various metal elements between the various parts of the sugarcane. Zhang *et al., (*2014) found out that the distribution of heavy metal in the sugarcane stem was irregular.

Figure 1: Sugar cane grown on a farmland

Figure 2: Sugar cane juice

Papalantois known for sugarcane cultivation; yet there is no data and information about the cultivars grown there in scientific literature as regards the heavy metals contents. The aim of this study was to determine the heavy metals present in the sugarcane juice commonly cultivated in Papalanto, Ogun state, Nigeria.

II. MATERIALS AND METHODS

Preparation of the Sugarcane Juice

The sugar cane stems were collected from Papalanto. They were washed with water to avoid contamination while peeling and crushing. The sugar cane were sliced intosmallerpieces in a tray and crushed with a crusher for juice extraction.The juice was collected in a plastic container and refrigerated at 4°C until when needed for analysis.Microwave assisted digestion technique was applied because of its ability to achieve high temperature and pressure and therefore attaining quick complete matrix destruction. The conditions for each digestion procedure were monitored and saved by the machine in order to ensure that the process is analytically reproducible. A temperature program was developed for the preparation of the juice. 10 mL of analytical grade of concentrated $HNO_3$was added to 5 mL of the juice in a polytetrafluoroethylne (PTFE) digestion vessel. Samples were prepared in triplicates. The samples were digested for 40 minutes, transferred into a 50 mL volumetric flask, and made up to the mark with distilled water. The resultant solutions were analyzed using the PerkinElmer Atomic Absorption Spectrophotometer, AAS according to the method described by Marguí*et al.*, (2010).The acid was used as reagent blank.

III. RESULTS AND DISCUSSION

Table 1: Heavy Metals Detected in Sugarcane Juice Cultivated in Papalanto

Heavy Metals	**Sample A (NPK-treated)** Concentration (mg/kg) (Mean±SD)	**Sample B (Untreated)** Concentration (mg/kg) (Mean±SD
Copper (Cu)	0.0913 ± 0.056	0.0023 ± 0.0006
Cobalt (Co)	0.1900 ± 0.013	0.0020 ± 0.0
Lead (Pb)	0.680 ± 0.106	0.003 ± 0.0006

Values are expressed as mean± standard deviation

Table 1 shows the heavy metal concentrations in the sugar juice samples assessed. Heavymetalswere detected in both samples. Sample A had significantly higher levels of Pb, Co and Cu than sample B. The differences observed in the levels of these heavy metals in the two samples could be due to variations in the availability of the heavy metals content of the soil (Collin and Doelsch, 2010, Wang *et al*., 2012, Nayak, *et al*., (2014).The industrial and vehicular activities around Papalanto could be a major source of these heavy metals.

IV. CONCLUSION

Further studies should be carried out to investigate other heavy metals or toxicants that might be present in the sugar cane or other crops grown in Papalanto, Ogun State, Nigeria.

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