International Journal of Life Science and Agriculture Research

ISSN (Print): 2833-2091, ISSN (Online): 2833-2105

Volume 02 Issue 08 August 2023

DOI: https://doi.org/10.55677/ijlsar/V02I08Y2023-07

Page No : 248-251

Telfairia Occidentalis Leaf Concentrations of Hg, Pb and Cd Planted in Old Sewage Sludge Dumpsites in Owerri Imo State

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ABSTRACT: Leaves of *Telfairia OCCIDENTALIS* planted in abandoned Sewage Dumpsite were analyzed for mercury Hg, Lead Pb and Cadmium Cd levels. Samples were collected from three dump areas at a depth of 0-30cm, and fallow lands of about 50 meters away from the dumps were also sampled for reference. The samples were subjected to analysis and Heavy metals were determined using Atomic Absorption Spectrophotometer (AAS). The findings indicated that sewage increased the soil concentrations of Heavy Metals (0.19 Hg, 17.0 Pb, and 3.0 Cd Mg/Kg[1]) when compared with control (0.04 Hg, 1.4 Pb, and 0.29 Cd Mg/Kg[1]). These were not high when compared with established permissible limits according to FEPA WHO. These concentrations were not high to cause health challenges. Many scientist reported that not all sewage sludge contains high amount of heavy metals especially when allowed to decompose for a longer period of 4 years even without prior treatment, but repeated application can increase levels. Sewage Sludge also increased N, P, K, Ca, Mg, K and ECEC and this may triggered the reason of continuous planting by farmers in dumpsites due to the fact that sewage sludge can increase the nutrient content of soil and improves its physical and chemical properties. Organic matter content which is also of great importance in soil reaction was increased by the sewage sludge deposit. The deposit of sewage sludge added organic matter, improved the soil physical and chemical properties, at the same time increased the heavy metals levels. But the heavy metals levels were not above permissible limits for heavy metal concentrations in soils. It is therefore recommended to land spray the sludge and allowed to decompose for about 2 years before planting on it. The result was discussed in-line with heavy metals in questions and permissible limits for each.

KEYWORDS: *T. Occidentalis*- Leaf-Sewage Sluge-Owerri-Imo State

Published Online: 18 August 2023

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1. INTRODUCTION

Sewage sludge is a good source of soil amendment because of its richness in organic matter and other sources of macro and micronutrients. These wastes enhances soil fertility and improve the physical properties of the soil (Anikwe and Nwobodo, 2002).

Scientifically, this perception did not translate into using untreated sewage sludge or other municipal waste for agricultural purposes without taken into account the composition of the waste (Anikwe and Nwobodo, 2002).

Sewage is the by-product(s) of domestic and, or municipal waste-water. Sewage sludge is the solid of the by-product (Brandy and Weil, 1999). The concern over-application of sewage sludge to the farm land is that, some sewage sludge contains high concentrations of heavy metals (Atlas *et al.*, 1998).

Many trace organic elements can be found in organic waste (Harrison, 1999). Some of these compounds are toxic, carcinogenic or cause reproductive or developmental defects in mammals (Stehouwer, 1998). There may be also, disease-causing organisms in these wastes (Krogmann and Boyles, 1999). Heavy metals are examples of these trace elements, and are metals that have high specific gravity or densities of 5.0 mg/m or greater. These Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Pb, Ni and Zn.

According to Opara-nadi and Okwe (2000), not all sewage sludges contain high concentrations of heavy metals, but toxicity to both plants and mammals – man and animal- can occur upon repeated application and uptake of biosolids (Atlas *et al., 1998).*

Uptake of heavy metals differs from plant to plant and phytotoxin occurring, the situation become worst when edible part is the site for accumulation and chemical reactions like the case of occidentalis.

2. MATERIALS AND METHOD

2.1 Study area

Selected dump sites along Owerri – Onitsha Road Imo State Nigeria were used.
The coordinates of Imo state is 5.5720° N, 7.0588° E. and falls within the tropical rainforest zone of Nigeria.

2.2 Sample collection

Sites were chosen as follow:

A. Sewage sludge dump site: Soil samples and 150 Leaves from actively growing occidentalis were collected randomly from the sites. The plant samples were stored in a paper envelop and labelled while soil sample were stored in a polyethene. The samples were air-dried and sent to laboratory for routine and heavy metal analysis.

B Control Site (Reference site) **Control site:**This is an un-dumped site with secondary re-growth forest.
The control site was chosen at a distance of about 50 meters away fromdumpsite. This site was carefully examined during the survey visit not to have been dumped before

2.3 Sample Preparation and Laboratory Analysis

Soil Sample Analysis

Samples were spread on clean and dry paper sheet for air drying. After air drying, the soil samples were crushed in clean ceramic mortar using a small ceramic piston. These samples were passed through 2-mm sieve to get a fine soil fraction (Nelson and Sommers, 1982). The fine soil fraction was used to extract heavy metals using the DTPA method (Lindsay and Norvell 1978). A 10 g of soil sample was mixed with 20 ml DTPA (0.05 M – adjusted to pH 7.3 with TEA), then shaken for 30 – 45 minutes before filtering through whatman No 1 filter.

The filtrate were analysed for heavy metals (Pb, Cd and Hg) on Atomic Absorption Spectrophotometer (AAS). Soil pH was determined in distilled (deionised) water (1:2.5 soil-water ratio) using glass electrode pH meter (Dewer model). Organic carbon was determined by the Walkley-Black wet oxidation method (Heanes, 1984). Exchangeable acidity was determined by the titration method (Westerman, 1990).

2.4. Data Analysis

Simple descriptive statistical method were used. The data collected were compared with control and already established permissible limitsaccording to the procedure described by Snedecor and Cochran (1980).

3.0 RESULTS AND DISCUSSIONS

3.1 Levels of Heavy Metal in the Dump Site

The result of the Heavy Metals in the soil is presented in table 1.
Sewage Sludge increased all the metal content significantly when compared with control.

Table 1. Soil Heavy Metal Levels as affected by sewage sludge dumping

Source	Hg	Pb	Cd
	……………………Mg/Kg^{1} …………………		
A	0.09^{a}	82.3^{a}	3.01^{a}
B	0.08^{a}	76.8^{a}	2.98^{a}
C	0.09^{a}	83.9^{a}	3.03^{a}
CONTROL	**0.03^{b}**	**31.4^{b}**	**1.02^{b}**

3.2 Leaf Hg, Cd and Pb levels.

Though plant differ in their uptake of heavy metals, the *occidentalis* mercury, lead and Cadmium content increased significantly when compared with control (table 2).

Table 2. Leaves concentrations of Hg, Pb and Cd as influenced by sewage sludge deposit

Source	Hg	Pb	Cd
	……………………………Mg/Kg^{1}……………………………		
A	0.06^{a}	6^{a}	0.09^{a}
B	0.07^{a}	6^{a}	0.10^{a}
C	0.07^{a}	8^{a}	0.09^{a}
Critical Range	**0.03**	**2**	**0.02**

Critical range (World Health Organization (WHO, 1996)

3.3 Discussion

Sewage sludge dumping affected the heavy metals by increasing its levels. Under environmental protection(Bragato*et al*., 1998), there are limits at which heavy metals do not exceed in the soil and edible parts.

Comparing the levels with control, these concentrations were high. This was supported by (Alloway, 1995), who reported that some sewage sludge contains high concentrations of heavy metals and their repeated application can increase levels beyond permissible limits.

4. CONCLUSION

The dumping of sewage sludge significantly increased the availability heavy metal and its levels but above permissible limits in soil and Occidentalis.

Therefore plants under these conditions are toxic to man through food chain (Walker, 1989).

Environmental contamination with lead causes foe toxicity of serious congenital malfunctions in human (USEPA, 1997), stunted growth, abnormal infants, spontaneous abortions in woman and brain damage may also occur (Mulchi*et al*., 1987).

Nickel in high concentration causes lung cancer while cadmium causes heart and kidney disease, and bone embrittlement (Brady and Weil, 1999). Mercury health effect impacts on cognitive thinking, memory, attention, language, and fine motor and visual spatial skills in children. For foetus, infants, and children, impaired neurological development cause by methyl mercury. Impairment of the peripheral vision, lack of coordination of movements disturbances in sensations may also occur.

For copper and zinc, the effect is low been an essential element, but vomiting is induced when zinc contact exceeds 8mg. Fever, excessive salivation and cough also occur (Matis and Kerven, 1975). Plant planted under zinc and copper contaminated soil, show less root development and unpaired shoot growth (Stehouwer, 2006).

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