

## Assessing Bioaccumulation in Earth Worms

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### Abstract

Various concentrations of lead (II) tetraoxosulphate (VI) were prepared by dissolving 1 g, 1.5 g, 2 g and 3 g of the salt in deionized water and making up to volume to 100ml. Soil samples were prepared and allowed to equilibrate with the different concentrations of the salt samples. After equilibration, earthworm species which had been acclimatized to the in-situ environment were introduced to the equilibrated soil samples. The earthworms were allowed to stay between 3-5 days in the soil samples. They were harvested and the lead (II) tetraoxosulphate (VI) content of the earthworm samples. The result showed that the earthworms possessed the ability to bioaccumulate the salt samples and the statistical analysis showed increase in bioaccumulation with increase in the salt content.

**Keywords:** Earthworm; Lead (II) tetraoxosulphate (VI); Protein; Carbohydrate; Atomic Absorption Spectrophotometer

### 1. Introduction

Lead is a group (IV) heavy metal that occurs naturally and is generally mined from its ores [1]. It has different application and uses such as in ceramic products, paints, as a shield against radioactive rays and other various applications. Lead is transported through eating food contaminated with lead, working places, health care products and hobbies. Industrialization, urbanization and the use of leaded product increases the deposition of lead on land, lake ponds leading to environmental pollution with effects on human health [2]. Lead accumulation causes physiological perturbations [3]. The deleterious effects of lead is due to the fact that human do not metabolize lead, thus they accumulate in the body tissues they exert some effects such as nervous system disorder. Bioaccumulation,

bioavailability and deposition of lead in an area could be assessed using earthworm [4]. There are about nineteen species of earthworm which has been described as the intestines of the soil (Aristotle 330 BC). Among these species of earthworm, the species most commonly used for bioaccumulation studies is *Lumbriculus Variegatus* [5-7]. The use of any species of earthworm in bioaccumulation studies is dependent on the ease of culture, chemical exposure history, adequate tissue mass for chemical analysis, tolerance to a wide range of chemicals, physiochemical characteristics, low sensitivity to contaminants and amenability to long term exposure [8]. The uptake of chemicals and heavy metals in earthworm is by passive diffusion driven by the fugacity difference between the earthworm and organism tissue. Earthworm is a common representative of the soil macro fauna thus the use in bioaccumulation studies. Bioaccumulation testing of heavy metal involving earthworms is a simple procedure in which earthworm is exposed to spiked soil for a given period after which the earthworm is harvested from the soil and analyzed for contaminant of interest. Some physiological parameters have also been noted to signal bioaccumulation [9] and relevant in this study is the total carbohydrate and protein. Earthworm apart from its use in bioaccumulation studies has also been used to break down organic residues such as sewage sludge, animal waste, industrial waste [10].

## 2. Material and Methods

Earthworm and soil samples were obtained from Obukpa, in Nsukka Enugu State Nigeria in the from moist soil sample. The soil analysis was carried out according to the method of Vogel (1965). Lead tetraoxosulphate (vi) of concentrations: 1%, 1.5%, 2% and 3% were prepared and introduced into 500g of the soil samples. After equilibration, the earthworms were rinsed with deionized water and introduced into the spiked soil samples. The earth worms were harvested after incubation period. The accumulated heavy metals in the tissues of the earthworms were determined, the effects of the accumulated heavy metals on the carbohydrate and protein content were also determined.

## 3. Results and Discussion

The result of the soil analysis indicates the absence of lead and that the texture class is loam-sand with about 2% organic matter content. In all the four salt concentrations, accumulation of the test sample was observed. This agrees with the findings of [11] who had also noted bioaccumulation in their study. The statistical analysis and the results also indicate increase in body's salt metal with increase in salt concentration until the lethal dose. In the preliminary investigation, it was observed that the lethal dose is 5% in the salt in 500 g of the soil sample. Lethal dose has also been observed by other authors [12] who noted toxicity with increase in salt concentration. During the research study the earthworms showed avoidance of tonic concentrations by their wriggling movement and the tendency to escape out of the enclosure.

The result of the statistical analysis also show that the concentration from 2% were significant in the bioaccumulation result. The result shows the ability of earthworms to bioaccumulate the salt samples. Bioaccumulation has been observed in earthworm *Lumbriculus variegates* [13]. The earthworms also avoided higher concentrations of the salt samples, this they could easily avoid if not in an enclosure. The result of the protein and carbohydrate analysis shows increase in the protein and carbohydrate levels after the introduction of the salt sample.

[14] in their research on *Dendrobaema rubida* had also similar observation. Studies on the effect of lead on carbohydrate metabolizing enzymes showed a reduction in the glycogen stores and increase in the activity of carbohydrate metabolizing enzymes suggesting an increase in the carbohydrate level [15, 16] which agrees with the result of this work. This study showed a time dependent increase in the carbohydrate concentration which has also been reported by other studies [17]. There was also increase in the protein concentration after the introduction of the lead samples which agrees with the result of [18] (Table 1-3).

Textural Class	% clay	% silt	% sand	pH H <sub>2</sub> O	0.1NKOL pH	% C	K	O.M	%N	H	P
LS	6.48	7.12	66.70	7.0	6.7	0.641	5.09	1.10	0.008	3.8	130.18

**Table 1:** Soil Analysis.

Salt concentration (%)	Lead accumulated (mg)
1	0.0045
1.5	0.1202
2.0	0.4718
3.0	0.4005

**Table 2:** Accumulation of lead tetraoxosulphate (vi) in the earthworms.

Salt concentrations	Carbohydrate concentration	%N	% crude protein
Control	0.012	0.1051	0.6567
1%	0.056	0.4102	2.5043

**Table 3:** Effects of accumulation of lead on carbohydrate and protein content.

#### 4. Conclusion

In conclusion it could be said that earthworms bioaccumulate heavy metals and could be used in bioremedial studies.

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