



## EARTHWORM CAST AS A SOURCE OF TRACE ELEMENTS TO TREAT HUMAN AILMENTS

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### Abstract

*Earthworms are not only the intestines of earth (Aristotle; 384-322 B.C.) but their cast serves as an important source of minerals and trace elements. (Ayoola and Olayiwola, 2014). The earthworms were also used in delaying the clotting time (Ang Lopez and Alis; 2006), to lower blood pressure, as a source of proteolytic enzyme (R. Guerrero and L. Guerrero; 2006b) etc. The dried earthworm casts were collected from the campus of Institute of Science, Nagpur (M.S.) randomly and were analysed for the presence of eleven trace elements using AAS and flame photometer. Of the eleven trace elements analysed, iron was found in high concentration (2007.71 mg/Kg) while the concentration of cadmium was lowest (0.11 mg/Kg). When the concentrations of trace elements were compared with the concentration of same trace elements from medicinal plants used to treat various human ailments, the potential of earthworm cast to treat human ailments became evident.*

*Key words: Earthworm casts, AAS, Flame Photometer, Trace elements, human ailments, medicinal plants.*

### I. INTRODUCTION

Earthworms are called “the intestines of the earth” by Greek philosopher Aristotle (384 – 322 B.C.), due to their burrowing habit. The casts produced through burrowing and eating the soil is rich in nutrients as compared to surrounding soil. Cleopatra (69 – 30 B.C.) recognized the earthworms’ contribution to Egyptian agriculture and declared them to be sacred. Charles Darwin (1809 – 1882) said, “It may be doubted that there are many other animals which have played so important a part in the history of the world as have these lowly organized creatures.”

The earthworm casts provide ideal microclimate for the growth of microbes. Casts also prevent the soil erosion. A rich source of protein (*Lumbricus rubellus*) (76%) has higher protein content than mammalian flesh (65%) or fish (50%). The antibacterial protein from earthworm inhibits *S. aureus*, *S. typhi*, *E. coli*. The earthworm enzymes play several roles like slowing of aging, stabilization of blood function, skin rejuvenation etc.

Earthworms are called friends of farmer owing to their diverse ecological services like increasing the porosity of soil, speeding up the rate of decomposition, etc. Numerous studies were performed related to the microflora of earthworm cast, trace element content of cast etc. Very few data, however, is available that discuss the relevance of earthworm casts as a source of trace elements which could be used for treatment of human ailments (Ayoola and Olayiwola, 2014).

### II. MATERIAL AND METHODS

The casts of *Eisenia foetida* were collected randomly from the campus of Institute of Science, Nagpur (M.S.). The samples were then dried in an oven at 60°C. The casts were ground in fine powder using mortar and pestle. Exactly 2.0 gm of powdered casts were weighed into the beaker. 60 ml of freshly prepared mixture of HNO<sub>3</sub>: H<sub>2</sub>O<sub>2</sub> (1:1 v/v) was added to the beaker. The initial reaction

was allowed to subside for 1 hour and then the mixture was heated on a hot plate at 80°C till the sample was reduced to approximately 5 ml.

The sample was allowed to cool and filtered through a Whatmann No.-1 filter paper. The sample was then diluted to 25 ml with distilled water. The sample is analysed using AAS and Flame Photometer.

### **Removal of Lead and Cadmium from the Earthworm Cast:**

Several techniques like soil washing, immobilization or phytoremediation can be used to remove heavy metals to make soil cultivable, reduce exposure to heavy metals, scale down land tenure problems etc. (Wuana and Okieimen, 2011). Lead and cadmium can be removed by shaking for 3 hours at the rate of 42.2-100% and 5.2-31.3% with 0.1 M acetic acid (Gzar, Abdul-Hamid, and Yahya, 2014).

The lead and cadmium can also be removed from the mixture of elements by methods like inorganic qualitative separation using HCl and H<sub>2</sub>S, mesityl oxide in 0.05 M KI (Rao and Ramkrishna, 1982). Cadmium can be effectively eliminated from acidic soils using lime (Vondrackova *et al.*; 2013).

## **III. RESULTS AND DISCUSSION**

The concentration of Fe (2007.71 mg/kg) was found to be highest from earthworm cast while the concentration of Cd (0.11 mg/kg) was lowest (Table-1 and Figure-1). The other elements were in concentrations of K (1075.87 mg/kg), Mn (610.95 mg/kg), Na (251.25 mg/kg), Zn (67.35 mg/kg), Cu (42.46 mg/kg), Pb (37.16 mg/kg), Cr (29.39 mg/kg), Ni (26.25 mg/kg) and Co (6.21 mg/kg) (Table-1 and Figure-1).

The concentration of elements like Fe (2007.71 mg/kg and 3000 mg/kg respectively) and Cu (42.46 mg/kg and 75 mg/kg respectively) from both earthworm casts and serum were comparable.

Of the eleven elements analysed, Fe, Na, Zn, Cu, and Ni levels are high as compared to medicinal plants. Some medicinal properties are known to be influenced by the concentration of trace elements in medicinal plants. When the essential trace elements from earthworm casts were compared with trace elements from medicinal plants, it can be concluded that the earthworm casts could serve as an excellent source of trace elements as compared to medicinal plants.

Human beings suffer when trace elements are present in excess or are deficient. Trace elements, thus, play an important role in smooth functioning of the body. Iron, being the very important constituent of human body, serves as oxygen carrier, electron carrier and part of enzymes. So it can be used for treatment of anemia, tuberculosis (Ayoola and Olayiwola, 2014). Sodium and potassium are the major electrolytes involved in cellular homeostasis, maintenance of osmotic pressure and pH, proper functioning of heart, renal regulation of acid base balance, enzyme cofactor etc (Pohl *et al.*, 2013). Potassium is important intracellular cation for all but one organism i.e. blue green algae. It is involved in maintaining the osmotic pressure, nerve transmission as well as muscle functioning.

The manganese is essential for the normal functioning of pituitary gland, pineal gland, liver etc. The Zinc is required for normal functioning of nerves, heart and male fertility. The natural concentration of Zn in soil is about 70 mg/Kg (Davies and Jones, 1988). The copper is essential for maintaining the strength of skin, blood vessel, connective tissue throughout the body (Osredkar and Sustar, 2011). Copper is present in crystal rocks at a concentration of 55 mg/Kg of soil. It plays a role in production of hemoglobin, myelin and melanin. Copper is involved in seed production, disease resistance and regulation of water in plants. However, at high concentration, it is anaemia, kidney and liver damage and stomach and intestinal irritation.

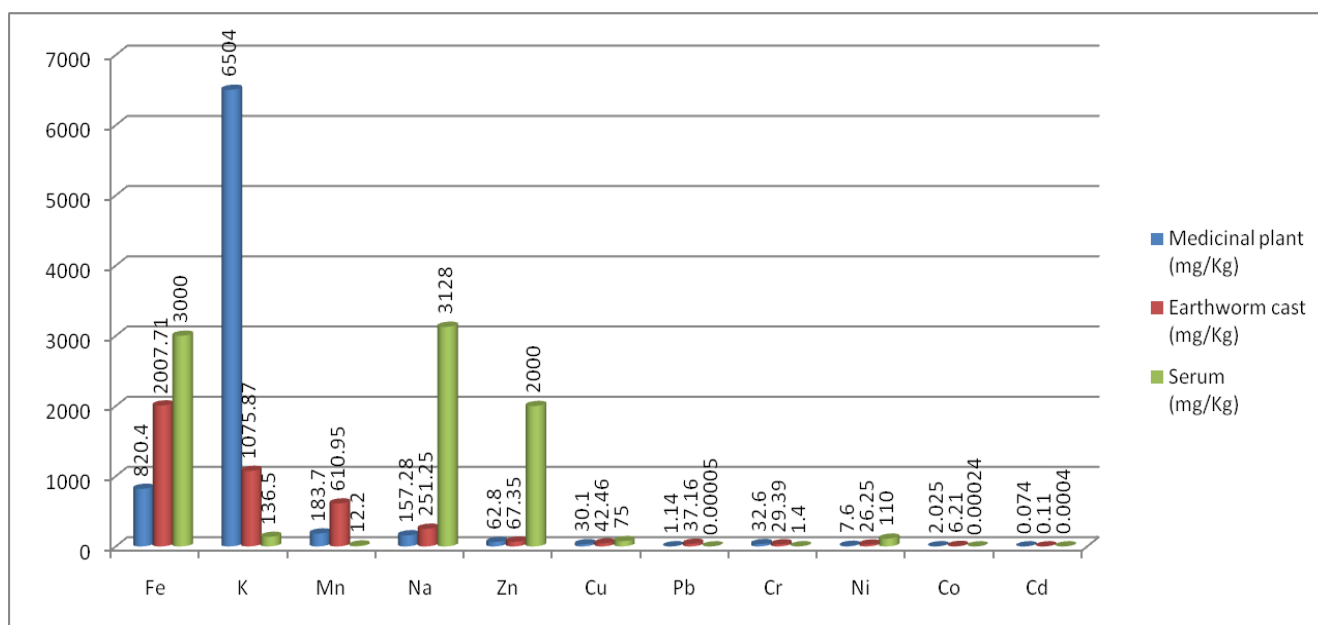
Chromium being part of a chromodulin, an oligopeptide that facilitates insulin binding to the receptors at the cell surface, is involved in prevention of diabetes (Pechova and Pavlata, 2007). Chromium is associated with allergic dermatitis in humans (Scragg, A. 2006). Nickel has a role in metabolism or structure of membrane, phospholipid synthesis, as a substitute for calcium (Nielsen,

1974). Cobalt being the constituent of cobalamine is involved in erythropoiesis and increased physical performance.

Lead inhibits heme synthesis and leads to anemia. Moderate exposure to lead results in CNS impairment, inattention and cognitive difficulties in children (Hutton, 1987). Children exposed to lead are at risk for lower IQ, hyperactivity, and mental deterioration. Adults usually experience decreased reaction time, loss of memory, nausea, insomnia, anorexia, and weakness of the joints when exposed to lead. Cadmium is primarily toxic to kidney causing proteinuria. It also cause bone demineralization, impaired lung function and lung cancer (Bernard, 2008). Cadmium is associated with itai-itai disease in Japan and is characterised by painful osteomalacia.

**Table 1: Trace element content from earthworm cast and the comparison of element content with serum and medicinal plants.**

Sr. No.	Element	Medicinal plants (mg/Kg)	Earthworm cast (mg/kg)	Serum (mg/kg)
1	Fe	820.4	2007.71	3000
2	K	6504	1075.87	136.5
3	Mn	183.7	610.95	12.20
4	Na	157.28	251.25	3128
5	Zn	62.8	67.35	2000
6	Cu	30.1	42.46	75
7	Pb	1.14	37.16	0.00005
8	Cr	32.6	29.39	1.4
9	Ni	7.6	26.25	110
10	Co	2.025	6.21	0.00024
11	Cd	0.074	0.11	0.0004



**Figure-1: comparison of trace element content from earthworm cast with medicinal plants and serum.**

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