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Effects of Hg/Co toxicity in Soil on Biomolecules of Earthworm, Eisenia Fetida

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Abstract

Heavy metals act as toxicants to soil and crops at elevated level. Earthworms help in bioremediation process they remove heavy metal from the soil and accumulate them in their body tissues especially yellow cells. Depending upon the concentrations of heavy metals the body of earthworm get affected. An experiment was conducted to check the effect of Hg and Co on Eiseniafetida. Nine concentration of heavy metals were sprayed i.e. Hg @0.02,0.04,0.06 ppm ,Co @0.02,0.04,0.06 ppm and Hg+Co @0.01 ,0.02,0.03 ppm for two months . Bio-molecular parameters were calculated at an interval of 15 days for 2 months And it was concluded that Hg at 0.006 ppm affect the biomoleculer concentration of body of earthworm than Co and combination of both. The carbohydrates level has been decreased from 17.65% in 0.06 Hg, 17.05% in 0.06 Co and 17.32% in combination of 0.03Hg+0.03Co. At 0.06ppm of Hg lipid content decreased by 41.25%, 23.26% at 0.06ppm Co and 32.44% at 0.03Hg +0.03 Co whereas protein concentration was decreased by 42.47% at 0.06ppm Hg, 35.27% at 0.06ppm Co and 38.07% at 0.03Hg+0.03Co. So it was concluded that Hg is more toxic to earthworm not only bio-molecular parameter it affect coccon production, coelomocytes, body weight, length also.

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Keywords: Earthworm, Eiseniafetida , Heavy metal, Biomolecules;

Introduction

The effects of heavy metals on soil organisms depend on exposure to concentrations that are available for uptake. Therefore it is important to know which metal species can be taken up by organisms and to determine the relative importance of different uptake routes. Earthworms can be exposed by direct dermal contact with heavy

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metals in the soil solution or by ingestion of pore water, polluted food and/or soil particles. Data reported in the literature indicate that soluble metal concentrations are the best descriptors of bioaccumulation in earthworms. Earthworms could be used to extract toxic heavy metals, including cadmium and lead, from solid waste from domestic refuse collection and waste from vegetable and flower markets, according to researchers writing in the International Journal of Environment and Waste Management. With rapid increases in urban populations particularly in the developing world, there is a growing problem of how to manage organic waste and to find alternatives to landfill disposal particularly for domestic food waste and that from vegetable markets. According to the research team, it is an unfortunate fact of life that much of this waste is currently dumped on the outskirts of many towns and cities and is causing serious pollution, disease risk and general ecological harm. It also represents a considerable wasted resource, whereas the organic matter might be exploited usefully in growing food crops. The process of vermi-composting in this way allows such waste materials to be remediated and the compost used subsequently for use in growing human food without the risk of accumulating heavy metals in crops. The team says that up to about three-quarters of thevarious heavy metals can be removed by the worms from solid waste.

The E. eugeniae species was the most effective worm at remediating solid waste and producing rich compost. The team's tests on vermi-composting reveal that the heavy metal content of such waste can be reduced to levels significantly below the permissible safe limits.

The worm's digestive system is apparently capable of detaching heavy metal ions from the complex aggregates between these ions and humic substances in the waste as it rots. Various enzyme-driven process then seem to lead to assimilation of the metal ions by the worms so that they are locked up in the organism's tissues rather than being released back into the compost as worm casts. The separation of dead worms from compost is a relatively straight forward process allowing the heavy metal to be removed from the organic waste.

Material and methods

The present study was carried out in vermi-technology laboratory in department of zoology, CCS Haryana Agricultural University, Hisar (Haryana). To study the effect of mercury and cobalt on earthworm *Eiseniafetida* @ different concentrations of heavy metals individually as well as in combination. Five replicates of each treatments i.e 50 tubs of biogas slurry were taken and 45 mature clitellated earthworms were transferred into each tub and following parameters were calculated @ 0, 15, 30, 45 and 60 day of treatment.

Table 1:

Sr. No.	Treatment	Concentration (ppm)
1.	Control	No treatment of heavy metals
1.	Mercury	0.02, 0.04 and 0.06
2.	Cobalt	0.02, 0.04 and 0.06
3.	Mercury+cobalt	0.01+0.01,0.02+0.02 and 0.03+0.03

2.1 Preparation of earthworm powder

After 15 days 15 sexually mature clitellated earthworms were taken from each tub (900mg/worm) were washed with running tap water to remove any dirt from body surface and then fed with wet blotting paper for 18-20 hrs to clear their gut. The gut cleared earthworms were again washed with distilled water. The living earthworms were left there at a temperature of 25˚c for a period of 72 hrs. Thereafter the earthworms are ground in homogenizer, mucus and coelomic fluid that oozed out digested the dead worms forming the brown coloured paste-earthworm paste which was dried and stored at 4˚c for further use.