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Strong Metal Communication Earthworm and Scientific Study

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Abstract- The earthworms are well known to play a significant role in the productivity of the soil macrofauna. In soil formation they are extremely important, primarily by consuming organic matter, fragmenting it and closely mixing it with soil mineral particles to form water-stable aggregates. In particular, the ability of earthworms to bioaccumulate is important for a biomonitoring organism. For this reason the Earthworm is likely to be an excellent organism.

Because of its sensitivity and availability to unknown metabolites, a method of bio-monitoring would be appropriate for assessing metal toxicity. Organisms like fish, snails, and plants were used as bio-monitors. While this method is useful and exciting, it is also somewhat restrictive, as it may only be appropriate for a particular combination of a living organism with certain substances. Therefore it is important to find suitable living organisms as bio-monitors for each type of evaluation. The article delineates the effects of heavy metals on soil, plants, human health and aquatic Life. Moreover, to explain the basic soil chemistry and potential risks of heavy metals

Keywords:Earthworm, heavy metals, Organisms, soil chemistry, metabolites

1. Introduction

Earthworms have been suggested for soil contaminants as a candidate biosurveillance organism. The effects of various chemical contaminants on earthworms were studied in order to create a biomonitoring system using earthworms. To determine the subsequent biological effects, the accumulation of both natural and depleted uranium in earthworms was analysed. The study showed that no mortality or weight reduction effects were observed but cytotoxic and genetic effects were reported at very low concentrations of natural uranium. Methyl mercury may be more easily absorbed and accumulated in earthworms among metals, suggesting the earthworm is an ideal candidate to track methyl mercury. Lee et al .also reported that bioaccumulation of metals by earthworms may be used as an ecological metal availability indicator. Metal contamination, on the other hand, has apparently had little impact on earthworm populations.

Chemicals and environmental risk assessments should be focused on combination results, rather than those of a single compound. In this sense, Natal-de-Luz et al. studied the effects of chromium , copper, nickel , and zinc contaminated sludge, and freshly spiked soils with the same metal mixture, on Eiseniaandrei. They observed a decline in metal bioavailability for earthworms, encouraged by the sludge 's high content of organic matter.

They reported that the effects of cadmium and zinc mixtures on Aporrectodeacaliginosa mortality were mainly antagonistic, and the extent of the antagonism depended on the relative concentrations of cadmium and zinc as well as the magnitudes of their concentration.

It also studied the effects of metal combinations and other chemical agents, such as pesticides, on earthworms. The impact on Lumbricid earthworms of a binary mixture of nickel and chlorpyrifos, an organophosphate insecticide, and found that both chemicals were accumulating rapidly to equilibrium. While the uptake of nickel followed the same trend as the single chemicals, the rates of uptake and removal of chlorpyrifos were higher; indicating a mixture of chemicals in the soil could increase the toxicity to species [1].

2. METHODS FOR THE DETECTION OF METAL TOXICITY BY USING EARTHWORMS

Metal contamination is a vital phenomenon of soil emissions. To avoid metal toxicity we must first consider the characteristics of the metal and determine its toxicity. However, the methods used to determine metal toxicity are also insufficiently sensitive, as metals can be toxic below the technological detection limits. To address this constraint, a lot of research has been done to improve techniques of detection or methods of assessment for soil metal contamination. In addition, metals' toxic actions often depend upon their metabolites produced in living organisms. But it is difficult to establish appropriate methods for determining metal toxicity. As we said earthworm is a candidate organism for pollutant evaluation, but is not useful for all chemical substances in soil. Therefore it is important to select the appropriate target substances when using the earthworm as a bio-monitoring organism for soil pollutants. We implemented different methods using earthworms.

Analysis of reproduction of earthworms is a valuable tool for determining chemical substances in the environment. It studied the impact of cadmium and zinc on Enchytraeusalbidus reproduction. Both metals had also influenced the reproduction of the enchytraeids.

- **8-Oxoguanine Generation in Metal-Treated Earthworm DNA**

Quantitative and qualitative analyses of the oxidative DNA damage generated in living organisms are useful for the evaluation of the genotoxic effects of soil pollutants, because all aerobic organisms are constantly exposed to oxygen molecules. In particular, 7,8-dihydro-8-oxoguanine (8-oxoguanine, 8-oxo-Gua), a major form of oxidative DNA damage, may have an important role in carcinogenesis, because it causes the GC-to-TA transversion type point mutation. 8-oxo-Gua is constantly generated in DNA and the nucleotide pool by reactive oxygen species (ROS), due to exposure to endogenous or exogenous factors [2,3].

3. THE EFFECT OF INDUSTRIAL HEAVY METAL POLLUTION ON MICROBIAL ABUNDANCE AND DIVERSITY IN SOILS

Metals are important components of the environment, the concentrations of which depend primarily on geological and biological processes in biological form. There are many definitions of heavy metals, and several of them are based upon these elements' mass density. Writers of various publications use different limits to describe the threshold density for a "hard metal," varying from 3.5 to 7 gccm-3, but most writers recommend that the heavy metal mass density should reach 4.5 gccm-3. Within the category of heavy metals it is possible to distinguish both elements vital to living organisms (microelements) and elements whose physiological function is unknown and thus "inactive" to organisms. Metals that serve as microelements in living organisms typically exist in trace quantities, which are specifically specified for each species, and both their deficiency and excess affect living organisms badly.

In many people's minds the word "heavy metal" is related to toxic metals. But that isn't always the case. The effect of any material on a living organism is always dependent on the concentration available to the cells. A variety of heavy metal ions are also important in low concentration metabolic processes, but are toxic at high concentrations. However, locally elevated levels of these elements can cause major environmental and health problems when metal release through different biological, geological and anthropogenic processes far exceeds its natural content resulting from metal cycling processes. Owing to the presence of metals in the atmosphere, and their danger to all living species, heavy metal contamination in terrestrial ecosystems is of great concern.

Given the significance of soil heavy metal contamination, and its effect on soil microorganisms, this research provides an overview of the nature of the problem when it comes to soil microbial community reaction to environmental contamination. The first part of this research deals with the abundance and function of micro-organisms in soils in this area. The next section concerns major sources of heavy metals in soils with special focus on the most significant source of soil contamination, i.e. human activity (and more specifically-manufacturing and mining). The following section addresses the impact on the microbial community in soils that toxic levels of heavy metals may have. The last two sections of this research explain how to deal with heavy metal contamination-one introduces the word phytoremediation (soil remediation with plant use) and the other focuses on the use of heavy metal resistant microorganisms in the soil remediation process [4,5].

4. THE EFFECTS OF HEAVY METALS ON SOIL MICROORGANISMS

Metals without biological function are generally tolerated at concentrations of just minutes, whereas essential metals with biological functions are generally tolerated at higher concentrations. They may have metabolic functions as enzyme constituents or fulfil structural demands, e.g. by supporting the cell envelope. Metal concentration and speciation often decide if this is beneficial or harmful to microbial cells.

Microorganisms are the first biota to experience overt and indirect heavy metal impacts. Some metals (e.g. Fe, Zn, Cu, Ni, Co) are vitally essential when occurring at low concentrations for many microbial activities. Often these metals are involved in the processes of metabolism and redox.

Metals in bacteria ,actinomycetes, and fungi promote secondary metabolism. For example, chromium has a stimulating effect on both the development of actinorhodin and the growth yield of the actinomycete S model. Colibral light. However, heavy metal high concentrations may have inhibitory or even harmful effects on living organisms. Adverse effects of metals on soil microbes result in decreased organic matter decomposition, decreased soil respiration, decreased diversity and declined soil enzyme activity. Any of the general morphological changes, life cycle disturbance, and pigmentation increase or decrease, are easy to observe and assess. Rajapaksha et al.[105] compared the soils (Zn and Cu) with toxic metal reactions of bacteria and fungi. They concluded that the bacterial community is more susceptible than the fungal community to increased concentrations of heavy metals in the soils. With growing metal levels the relative fungal / bacterial ratio increased. These authors also found the varying effect of soil pH on the microbial response to soil contamination, i.e. that lower pH in polluted soils increased the negative effect on bacteria, but not on fungi.

The toxic concentration of heavy metals can cause damage to enzymes and hence their inactivation, as toxic metals with similar structure can displace the enzyme-associated metals. In addition, heavy metals change the conformational structures of nucleic acids and proteins, and thus form complexes with protein molecules that inactivate them. These effects contribute to degradation of the integrity of the microbial cell membrane, or destruction of the whole cell. Heavy metals with important metabolites can form precipitates or chelates [6].

5. Conclusion

The term metal toxicity or metal poisoning refers to the toxic effects on living organisms of certain heavy metals in certain forms and dosages. So it can be concluded from the review that earthworms have tremendous potential to take heavy metals from such contaminated media / soils. The two species accumulated heavy metals higher than the control worms. Some heavy metals zinc and lead to toxic effects on living organisms, mainly human beings. Some metals have no or little biological role and are not even essential minerals but in some form they are toxic to living organisms. Sometimes these heavy metals imitate the action of essential elements in the body, thus interfering with the metabolic process leading to illness.

Many research has revealed that earthworms can enhance soil fertility by stimulating soil physical, chemical , and biological properties. Also, they can change soil ecology by suppressing plant pathogens and promoting soil microflora and fauna growth. More recently, earthworms have been shown to be not only resistant to metal toxicity but also able to accumulate heavy metals in their body tissues and increase metal absorption. This newly explored earthworm feature can provide many advantages for soil quality monitoring, pollution assessment and phytoremediation. It should be borne in mind, however, that earthworm – heavy metal relations are mostly driven by soil characteristics and their ecological categories [7,8].

The current state of heavy metal bioremediation reviewed in this study shows great promise for metal biosorption and detoxification, in particular from biofilm and genetically modified microbes. In recent years, biofilm-mediated techniques, microbial gene transfer, and techniques based on microbial fuel cells have emerged as strong contenders. The peptidoglycan and polysaccharides component of the biosorbents cell wall is an active binding site for greater metal absorption. This technique is cost-effective and has advantages like faster kinetics, high metal binding over a wide range of pH, and temperature. This review provides an opportunity to reveal the role that microbial cells, biofilms, and their metabolites play in heavy metal remediation and environmental research. Further research area for heavy metal remediation needs to be broadened to focus on gene transfer within biofilms. These would facilitate the development of enhanced bioremediation techniques for heavy metals in the ecosystem.

In both aquatic and terrestrial ecosystems heavy metals and metalloids are ubiquitous pollutants to the environment. The hazard of an environmental chemical is a function of its persistence, toxicity and bioaccumulative potential in the environment. More hazardous are toxic environmental chemical substances that are persistent and bioaccumulative. Because of these three characteristics heavy metals are considered hazardous: persistence, bioaccumulation, and toxicity (PBT). Most hazardous heavy metals and metalloids are environmentally relevant and include Cr, Ni , Cu , Zn, Cd , Pb, Hg, and As. In aquatic and terrestrial food chains / webs the trophic transfer of these elements has important implications for wildlife and human health.

Assessing and monitoring the concentrations of potentially toxic heavy metals and metalloids in different segments of the environment as well as in resident biota is very important.

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