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Heavy Metal Pollution in Water and its Toxicity

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Abstract

Water is essential for life, yet in modern India, water contamination is the biggest concern. Numerous heavy metals, some of which may be harmful, are transported to the nearby water environment via a variety of routes. Growing industrial development, urban development, E-Waste, wastewater irrigation, and sewage have all contributed to a serious problem with water quality. When compared to national and international organisations like the WHO and USEPA, the quantities found were higher above the maximum permissible and recommended limit. Developmental retardation, neurotoxicity, kidney damage, many malignancies, liver damage, lung damage, brittle bones, and even mortality have all been related to chronic and acute exposure to heavy metals. The impacts of contaminated water on human health are discussed in this article.

Keywords: Esophageal cancer ; Radiation toxicity; Cardiac toxicity

Introduction

Although it is most frequently used to refer to any decline in the physical, chemical, or biological quality of the environment[1], environmental pollution can apply to any change in the environment. Environmental toxicology's main interests are the movement and impact of toxicants and their metabolites in the environment, in food chains, and on the composition and operation of biological systems. There are many different issues covered by toxicology. One of them is environmental toxicology[2]. The interplay between man and the

The rapid exploitation of natural resources, technological advancement, and industrial expansion are the most obvious causes of environmental degradation. As a result, the environment has been deteriorating. Around the world, environmental toxicity contributes to health issues, environmental deterioration, and ecological imbalance. Human health is impacted by pollution in some way, whether directly or indirectly. Several things can lead to toxic environmental conditions[3,4].

Heavy Metals Contamination and Toxicity in Soil Ecosystem

Well-known toxic pollutants have disastrous effects on the biological circulation of terrestrial organisms with changes in the structural composition of nucleic acids, proteins, and osmotic equilibrium. Heavy metal accumulation in soil is dangerous to the environment and human health. Although a number of remediation methods, including chemical oxidation/reduction, soil leaching, hardening/stabilization (S/S), and electro kinetic remediation, are employed to fix, remove, or detoxify heavy metals (HMs) in the soil, these conventional methods do not lead to overall sustainability[5]. In addition to harming aquatic creatures, soil flora, plants, animals, and people are also negatively impacted by metal poisoning. Cell morphology is harmed by oxidative stress, which also stops cytoplasmic enzyme activity. These metals often occur alone or in groups with other elements in nature, but anthropogenic activity raises their concentrations in the environment. Since HMs are water-soluble, solutions are where you'll find them most often. This makes it challenging to separate by physical and chemical means in the soil. Chemical morphology of HMs in the environment determines how soluble they are. Therefore, adequate strategies for converting HMs into transportable forms (such acid-soluble fractions) are required to increase the remediation effectiveness of the microbial fuel cell (MFC). Small-molecule organic acids (citric acid, CA, and acetic acid, Hack), inorganic acids (Hall, HNO), and artificial chelating agents (ethylenediaminetetraacetic acid, EDTA) have all been utilised as auxiliary reagents in several studies. These substances aid in the desorption and dissolution of HMs in the soil, enabling them to circulate more freely. Since polymer chelates travel slowly in electric fields and secondary ecological situations, synthetic chelating compounds provide a problem[6,7]. Two small-molecule organic acids (CA, HAc) that are widely accessible, moderately priced, and environmentally safe were utilised in this investigation, along with a mineral acid (HCl). The problem of HM contamination has increased due to the industrial sector's rapid progress, much like the demand for other metals has increased. The principal applications for heavy metals like Cd, Pb, As, Cr, Cu, and Zn are in industry and agriculture. These metals are dangerous in even trace concentrations[8]. Even though these metals are naturally present in the environment, tampering happens when there are significant levels of these metals on land as a result of ongoing mining and smelting. The problem of HM pollution gets worse as industrialization advances and the natural biogeochemical cycle is disturbed. Contrary to biological substances, heavy metals seldom biodegrade, which causes them to accumulate in the environment[9]. As an organism moves from low to high trophic levels, HMs accumulate in its tissues (a process known as bioaccumulation), and their concentrations rise (biomagnification). Due to toxicological effects from heavy metals in the soil, soil microbial activity and population decline[10].

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