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RESEARCH ARTICLE

Environmental Toxicants and Cardiovascular Risk: A Review on Heavy Metal Pollution and Heart Health

Dr. USHAA ESWARAN[1], R.THIYAGARAJAN[2], PRADEEPA K[3], K RAMYA SREE[4]&UMA MAHESWARI[5]
MAHALAKSHMI TECH CAMPUS, CHENNAI, CHROMPET-600044

*Corresponding Author

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Abstract: Heavy metal polluted the environment and its boxes with heavy metals. It acknowledged the context of its ability to nurture life and deliver its inherent values. Heavy metals are known to be naturally occurring compounds, but anthropological activity introduces them in large quantities in various ecological boxes. This leads to the ability of the environment to nurture life when human, animal and plant health is at risk. It is caused by bioacumulation in food systems as a result of the degradation of heavy metals. The solution of heavy metals requires special attention to protect the soil quality, air quality, water quality, human health, animal health, all parts as a whole. Advanced physical and chemical heavy metal solution technologies are impractical and time consuming and require additional emissions to the environment.

Keywords: Heavy metals, Cadmium, Chromium, Copper, Nickel

INTRODUCTION

Heavy metal pollution correspond to an important environmental problem due to its toxic effects and accumulation throughout the food chain and consequently in the human body. Metals like Cadmium, Chromium, Copper, Nickel, Iron, Lead, Mercury, Cobalt, Platinum, Uranium and Zinc are found in nature and they are toxic to the environment. The heavy metals present in water enters into the human body and affects the human food chain causes diseases to humans. Heavy metals consists of more toxic metals and accumulates itself in the soft tissues. Heavy metals toxicity can cause damage in central nervous function, lower energy levels and infact it may cause damage to lungs, kidney, liver and other vital organs. Long term exposure may result in slow process in the physical, muscular and neurological degenerative process that mimic Alzheimer's diseases, allergies, muscular dystrophy and multiple sclerosis. Sometimes, allergies which are not cured in early stage and repeated long term contact with metals which may lead to cancers. The main treatment process for the removal of ions include evaporation, precipitation, membrane separation, adsorption and ion exchange processes which are being used to remove Copper(II) ions from waste water. These techniques are most appropriate in situations where the concentration of the heavy metal ions is comparatively high [1].

When heavy metals are existing in the waste water at low concentration, they are either ineffectual or costly.Some of the techniques which are used for removing metal from industrial effluent include techniques such as filtration, chemical precipitation, ion exchange, adsorption, electro deposition and membrane systems.The treatment of heavy metals is of special concern due to me recalcitrance and persistence in the environment. In recent years, various methods for heavy metal removal from wastewaterhave been extensively studied. This paper reviews the current methods that have been used to treat heavy metal wastewater and evaluates these techniques. These technologies include chemical precipitation, ion exchange, adsorption, membrane filtration, coagulation-flocculation, flotation and electrochemical methods. About 185 published studies (1988–2010) are reviewed. It is evident from the literature survey articles that ion-exchange, adsorption and membrane filtration are the most frequently studied for the treatment of heavy metal wastewater [2].

Chromium is one of the major contributors to heavy metal pollution in surface waters. The treatment and removal of heavy metals has received considerable attention because of their association with various health problems. It is known that legal standards on environment control are becoming stricter and, as a result, the discharge of heavy metals into aquatic bodies and sources of potable water is being rigorously controlled. Industries typically use chromium in electroplating, leather tanning, metal finishing and chromate preparation. The tanning industries, due to the complexity of transforming animal hide (or skins) into leather, use large amounts of chemical agents and produce an enormous volume of residual waters and solid effluents. They are also common ground water contaminants at industrial and military installations. Some industrial effluents can contain chromium at concentrations ranging from tenths to hundreds of mg/1. Chromium is considered by the IARC to be a powerful carcinogenic agent that modifies the DNA transcription process causing important chromosome aberrations. On the other hand, the presence of chromium in watercauses significant environmental problems. The National Institute for Occupational Safety and Health (NIOSH) recommends that the levels of chromium in water should be reduced to 10-3 mg/m3. Chromium has been reported to be toxic to animals and humans and is known to be carcinogenic [3].

Many chromium compounds are relatively water insoluble. Chromium (III) compounds are water insoluble because these are largely bound to floating particles in water. Chromium (III) oxide and chromium (III) hydroxide are the only watersoluble compounds. Chromium (VI) oxide is an example of an excellently water soluble chromium compounds, solubility = 1680 g/L. Chromium does not occur freely in nature. The main chromium mineral is chromite. As was mentioned earlier, chromium compounds can be found in waters only in trace amounts. The element and its compounds can be discharged in surface water through various industries. It is applied for example for metal surface refinery and in alloys. Stainless steel consists of 12-15% chromium. Chromium metal is applied worldwide in amounts of approximately 20,000 tons per year. It may be polished and it does not oxidize when it comes in contact with air [4].

The metal industry mainly discharged trivalent chromium. Hexavalent chromium in industrial wastewaters mainly originates from tanning and painting. Chromium compounds are applied as pigments, and 90% of the leather is tanned by means of chromium compounds. Wastewater usually contains about 5 ppm of chromium. Chromium may be applied as a catalyser, in wood impregnation, in audio and video production and in lasers. Chromite is the starting product for inflammable material and chemical production. Chromium may be present in domestic waste from various synthetic materials [5].

Chromium (IIT) oxides are only slightly water soluble,therefore concentrations in natural waters are limited. Cr^{3+} ions are rarely present at at pH values over 5, because hydrated chromium oxide ($Cr(OH)_3$) is hardly water soluble. Chromium (VI) compounds are stable under aerobic conditions, but are reduced to chromium(III) compounds under anaerobic conditions. The reverse process is another possibility in an oxidizing environment.

Chromium is largely bound to floating particles in water. The value of LC-50 for chromium in sea fish lies between 7 and 400 ppm, for daphnia at 0.01- 0.26 ppm, and for algae at 0.032 6.4 ppm. Chromium (VI) compounds are divided up in water hazard class 3, and are considered very toxic to the environment [6].

Chromium phytotoxicity is undetermined. At concentrations of between 500 and 6000 ppm in soils, plants were not damaged. Lime or phosphate in soils may further decrease chromium susceptibility. Air dried soil generally contains 2-100 ppm of chromium. Chromium solubility in soil water is lower than that of other potentially toxic metals. This explains the relatively low plant uptake. Under normal conditions plants contain approximately 0.02 - 1 ppm chromium (dry mass), although values may increase to 14 ppm. In mosses and lichens, relatively high chromium concentrations can be found. Chromium (VI) compounds are toxic at low concentrations for both plants and animals. The mechanism of toxicity is pH dependent. These compounds are more mobile in soils than chromium (III) compounds, but are usually reduced to chromium (III) compounds within a short period of time, reducing mobility. Soluble chromates are converted to insoluble chromium (III) salts and consequently, availability for plants decreases. This mechanism protects the food chain from high amounts of chromium. Chromate mobility in soils depends on both soil pH and soil sorption capacity, and on temperature. The guideline chromium is agricultural soils is approximately 100 ppm. Chromium naturally has four stable isotopes. There are instable isotopes. The S'Cr, which is applied for diagnosis purposes, has an average degree of radioactivity [7].

Hexavalent chromium is known for its negative health environmental impact, and its extreme toxicity. It causes allergic and asthmatic reactions, is carcinogenic and is 1000 times as toxic as trivalent chromium. Health effects related to hexavalent chromium exposure include diarrhoea, stomach and intestinal bleedings, cramps, and liver and kidney damage. Hexavalent chromium is mutagenic. Toxic effects may be passed on to children through the placenta. Chromium (VI) oxide is a strong oxidant. Upon dissolution chromium acid is formed, which corrodes the organs. It may cause cramps and paralysis. The lethal dose is approximately 1-2 g. Most countries apply a legal limit of 50 ppb chromium in drinking water. A professional illness in chromium industries is chromium sores upon skin contact with chromates. Chromium trioxide dust uptake in the workplace may cause cancer, and damage the respirational tract [8-10].

Chromium has a large influence upon drinking water quality. It cannot normally be found in ground water and surface water in considerable concentrations. Specific removal in sewage water treatment is therefore unusual. Chromium removal from water is optional. Chromium (III) may precipitate as hydroxide. Coagulation is not a very effective mechanism of chromium (VI) removal. When iron sulphate is applied chromium (VI) may be reduced to chromium (III) by means of iron ions, and it can be removed.

CONCLUSION

Heavy metals have a wide variety of components that vary in chemical nature and biological activity. Heavy metals have been placed in the environmental pollution category as they are toxic to plants, animals and humans. Heavy metal contamination of the soil is the result of anthropological and natural processes. Anthropological activities such as mining, smelting, and agriculture have elevated dangerous levels in the soil of locally heavy metals such as Cd, Ni, Co, Pb and As. As heavy metals exist in nature, they accumulate in soil and plants. Consumption of many heavy metals by plants can be harmful to human health in the long run.

The impact of heavy metals leads to accidental accumulation in the ecosystem as a result of pollution from various diffusions or point sources.

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