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MERCURY (Hg) CONTAMINATION IN LIVING ORGANISMS

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Abstract

Mercury has been used for various purposes. Prehistoric cave drawings were made using cinnabar, the red ore containing mercuric sulfide. Today, mercury is produced as a by-product of gold and bauxite mining. Medicinal uses of mercury have included its use as a diuretic, antiseptic, skin ointment, laxative, and as a treatment of syphilis. Mercury has also been used as a poison. Inorganic mercury, found mostly in the mercuric salt form (eg, batteries), is both toxic and corrosive. The toxicity of methyl mercury was recognized worldwide following epidemics of mercury poisoning in the Japanese inhabitants due to consumption of fish caught in the region. The enhanced levels of concentrations of this metal (Hg) especially have drawn public attention resulting from food safety issues and potential health risk. This is regarded as the most important contaminants in our environment. The district is facing a threat of heavy metal (Hg) contamination but the results of the present study suggest that the rising levels of these metals are alarming and a matter of concern. The enhanced levels of Mercury can disturb human body metabolism to a dangerous extent.

Keywords : *Heavy Metal, Metabolic, Contamination, Toxicological.*

Discussion and Results

The term ―heavy metals, refers to any metallic element that has a relatively high density and is toxic or poisonous even at low concentration [1]. ―Heavy metals‖ is a general collective term, which applies to the group of metals and metalloids with atomic density greater than 4 g/cm3 , or 5 times or more, greater than water [2]. Heavy metals include lead (Pb), cadmium (Cd), zinc (Zn), mercury (Hg), arsenic (As), silver (Ag) chromium (Cr), copper (Cu) iron (Fe), and the platinum group elements. Elemental mercury Hg (0) is found as a liquid and it is the most volatile form of mercury with a vapor pressure of 0.3 Pa at 25°C. This means that elemental mercury is extremely volatile. The rate at which mercury volatilizes is directly related to temperature, as the temperature increases so does the amount of mercury in the surrounding air. Safety issues within the laboratory arise when mercury is heated or atomized into small particles. Mercuric chloride was used as an antiseptic and it is

still used for many other applications including wood preservative, photographic intensifier, dry battery depolarizer, tanning agent for leather, catalyst in the manufacture of chemicals such as vinyl chloride and disinfectants, separating lead from gold, and others. Mercuric nitrate, commonly used in the felting industry, is considered to be the source of the neurological changes. Mercury is present in the earth's crust at a concentration of 0.5 ppm. Mercury typically forms the sulfide of Mercury (HgS) because of the prevalence of sulfides in volcanic gases. Mercury can occur naturally in a variety of valence states and conjugations, such as Hg (0) (elemental mercury), Hg+2 (dissolved in rainwater, or as the ore cinnabar, HgS), and as an organo metal such as methyl mercury (CH3Hg and (CH3)2Hg) [1]. Forest fires, oceanic releases also contribute to mercury exposure. Anthropogenic activities also cause emission of mercury in different forms. These include chlorine – alkali manufacturing, dental fillings, gold mining, electrical equipments, skin care products, medicinal products, contaminated diet, polluted sediments, fungicides and pigments [2]. A potential source of exposure to metallic mercury for the general population is mercury released from dental amalgam fillings. The amalgam used in silver colored dental fillings contains approximately 50% metallic mercury, 35% silver, 9% tin, 6% copper, and trace amounts of zinc[3]. Another source of exposure to mercury may be religious, ethnic or ritualistic practices by some specific communities. Metallic mercury is used in a variety of household products and industrial items, including thermostats, fluorescent light bulbs, barometers, glass thermometers, and some blood pressure devices.[4] The mercury in these devices is contained in glass or metal, and generally does not pose a risk unless the item is damaged or broken, and mercury vapors are released.

Toxicological Effects of Mercury on Living Beings

Mercury is one of the greatest toxic threats to human health. An extensive number of research studies have thoroughly documented the human health risks associated with the use of mercury related things. Mercury is the toxic substance that attacks the central nervous system[5]. It can cause life-long disability and in extreme cases, death. Scientific data from all over the world suggest that mercury in amalgam filling can be associated with Alzheimer's disease, antibiotic resistance, cardiovascular problems, hearing loss, kidney disease, Parkinson's disease, reproductive dysfunction and many other problems. The kidneys are also sensitive to the effects of mercury, because mercury accumulates in the kidneys and causes higher exposures to these tissues, and thus more damage. In addition to this, inorganic mercury can damage stomach and intestine [6].

The proportions in which components are present in any sample are determined by quantitative chemical analysis. The main techniques employed in quantitative analysis are based on:

(1) The quantitative performance of suitable chemical reactions and measuring the amount of reagent needed to complete the reaction.

(2) Appropriate electrical measurements.

(3) The measurement of certain spectroscopic properties.

(4) The characteristic movement of a substance through a defined medium under controlled conditions.

In general, the toxicity of metal ions in mammalian system is due to chemical reactivity of the ions with cellular structural proteins, enzymes and membrane system. These heavy metals have been shown to cause acute as well as chronic poisoning in man and other animals. The presence of heavy metals in excess in the environment may cause a serious risk for the living organisms. These heavy metals bio accumulate and bio magnify in the living organisms and the food chain becomes the main gateway through which persistent heavy metals enter higher organisms [3]. All the human blood samples collected from different areas of district Hathras in Uttar Pradesh, were investigated. The selected heavy metal mercury (Hg) was qualitatively analyzed in human blood samples as per the procedure suggested [4] . The results of qualitative analysis of the heavy metal in human blood samples reveal that 12% blood samples out of total samples were found to be positive regarding presence of Hg upto 0.05 ppm. 48 % out of total samples were found to have Hg within the range of 0.05 to 0.10 ppm. 32 % samples indicated presence of Hg within the range of 0.10 to 0.15 ppm and 08% samples were found to contain Hg within more than 0.15 ppm. Following table illustrates the study of identification of selected heavy metal ions in collected blood samples.

S. NO.	**Frequency**	**Concentration of Hg (in ppm)**
1	06	0.001 -0. 05
2	24	0.05-0.10
3	16	0.10-0.15
4	04	More than 0.15
Total	50	

The results obtained from one way ANOVA for concentration of mercury in human blood samples collected from different regions of Hathras (U.P.) are given in table, where mean value, standard deviation, standard error and 95% confidence interval values are

depicted. The concentrations of mercury in blood samples collected from Hathras (U.P.), were found to be significantly higher. The enhanced levels of concentrations of this metal (Hg) especially have drawn public attention resulting from food safety issues and potential health risk. This is regarded as the most important contaminants in our environment. The district is facing a threat of heavy metal (Hg) contamination but the results of the present study suggest that the rising levels of these metals are alarming and a matter of concern. The enhanced levels of Mercury can disturb human body metabolism to a dangerous extent.

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