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RESEARCH ARTICLE

IMPACT OF LEAD CONTAMINATION IN WATER, SOIL, FODDER GRASS, MILK IN AND AROUND THE AREAS OF MUSI RIVER

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A B S T R A C T

The most threatening problem of Musi river pollution is from water soluble, non volatile, fairly reactive heavy metals. These exhibit properties of high toxicity, bioaccumulation (or) carcinogenicity when they combines with organic molecules. These have applications as chemical intermediates in the manufacture of pharmaceuticals, chemicals, paints, dyes etc. The discharges from the industrial units engaged in these activities in and around Hyderabad, find their way into Musi river and environment.

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INTRODUCTION

The most threatening problem of Musi river pollution is from water soluble, non volatile, fairly reactive heavy metals. These exhibit properties of high toxicity, bioaccumulation (or) carcinogenicity when they combines with organic molecules. These have applications as chemical intermediates in the manufacture of pharmaceuticals, chemicals, paints, dyes etc. The discharges from the industrial units engaged in these activities in and around Hyderabad, find their way into Musi River and environment.

The seriousness of pollution problems in the villages down stream of Musi can be judged from the concentration of heavy metals like lead, cadmium, nickel, chromium, zinc, selenium etc., recorded in sewage sludge and fodder grass grown in the sludge. The data is given in state of environment report for Hyderabad published by Environment Protection Training and Research Institute (EPTRI) in 1996. It is also evident from discoloration of brass vessels, silver ornaments, silk used in some of the villages along Musi river (Rama Rao) [1].

Farmers in and around Hyderabad (AP) state irrigate with waste water. Waste water is generated by the large and rapidly growing urban population of nearby 4 million people and discharged into the Musi River that flows through Hyderabad city. The sewage drains are located at several points down stream of the city walls along with river. Approximately 15974 hectares of land in and down stream of Hyderabad are irrigated with waste water (or) combination of Waste Water. Urban, periurban and rural agriculture is supported by the use of waste water. Farmers use waste water to irrigate due to mainly to the fact that fresh water is scarce. Rainfall is low and sporadic (700-800 mm per year) and it is concentrated into four months of the year. Ground water is difficult to access due to the hard rock morphology. In urban areas, the main crop grown with waster water is paragrass, a type of fodder grass cultivated for dairy production, banana leaves and coconut palm leaves are also harvested for ceremonial use and there is also some leafy vegetable production. Urban farm land is located in a thin strip within a 100 km. stretch along Musi River. Buffaloes used for dairy production are brought to waste water filled river to bathe. In the urban area, the Para grass is the main crop grown, in close proximity to expanding areas of vegetable and herb cultivation and vastly shrinking areas of paddy rice production. The declining waste water quality has reduced paddy rice yields to such an extent that it is no longer a profitable activity in this area on the other hand skin irritations were common complaints among the farmers and laborers in urban and rural waste water irrigated areas.

In the rural areas, paddy rice remains the main crop cultivated with waste water. Although the water quality is better than in the per urban (or) urban areas, waste water quality is also declining leading to greater pest infestations and reduced yields. 97% of domestic waste water in Hyderabad receives little (or) no treatment and untreated industrial effluents as well as hospital and commercial waste is released with domestic sewage into river. There are 12 industrial areas within 30 kms of Hyderabad. The common effluent treatment plants (CEPT) are unable to treat effluents adequately due to many types of effluent received and to the lack of pretreatment in the industries. For the Musi, it is roughly estimated that about 7-15 million liters per day of industrial effluents is released into the sewage system report by Hyderabad metropolitan water service and sewage board.

Most of our water resources are gradually becoming polluted due to the addition of foreign materials from the surroundings.

These include organic matter of plant and animal origin, land surface washing and industrial and sewage effluents, rapid urbanization and industrialization with improper environmental planning leads to discharge of industrial and sewage effluents into lakes. The lakes have a complex and fragile ecosystem, as they do not have self cleaning ability and therefore readily accumulate pollutants[2].

Cag Report[1]

The CAG which reviewed the activities, programmes and policies relating to the Control of Water Pollution during 1994-2000, in its report placed before the Andhra Pradesh state Assembly on 31-03-2001, stated that ground water in areas along Musi river contained high levels of pollution and endangered public health. The water samples collected from downstream of Musi and analyzed by private agencies are also reported to have shown high levels of lead, chromium, mercury and arsenic in ground as well as surface waters.

Eptri Report[1]

It is estimated that about 350 million tones of load is being pumped into Musi every day along with untreated and under treated industrial effluents being let out into the river. Because of predominant conditions of scant flows for most part of the year, the Musi River cannot provide even the minimum dilution required to keep the concentration levels within stipulated limits. The other point in residues of toxic Heavy metals and persistent organic halogen compounds, which are not being tracked, are finding their way along with the effluents.

Lead Contamination

Lead in the environment exists almost entirely in the inorganic form but small amount of organic lead results from the use of leaded gasoline. Lead also found in soil, vegetation, animals, food, water, air in the vicinity of high ways although its level decreases exponentially with the distance from the road, lead levels in sewage sludge may vary between 2000 to 8000 ppm and its use as fertilizers may give rise to subsequent contamination of agricultural soil. Lead is an element that has been identified as a potential hazard for the micro organism, plants, animals, under heavy metal application. The enzymes cannot function properly and this leads to reduced photosynthetic CO_2 fixation and ultimately less starch content. Apart from Lead there are other heavy metals which are harmful because they are non-biodegradable and cause adverse effects in human beings certain levels so analysis of heavy metals in soil, water, fodder, milk, is important because of its toxicity. Eg., Lead affects the central nervous sytem, abdominal pain, headache, adrenal insufficiency, allergies, anemia, anorexia, anxiety, arthritis, attention deficit disorder, autism, back pain, behavioral disorders, blindness, cardiovascular disease, cartilage destruction, coordination loss, constipation, convulsions, deafness, emotional instability, epilepsy, fatigue, hypertension, hallucinations[3,4,5].

Equipment and Apparatus

- Atomic absorption spectrophotometer.
- Ultra-violet visible spectrophotometer.
- Glass apparatus.
- Annular grade chemicals.
- Air dryer.
- Furnace.

METHODOLOGY

Heavy metal contents of soil, water, fodder, milk samples are determined by Atomic Absorption spectrophotometer model using flame atomization and HGA 400 graphite furnace. All the samples are air dried for 10 min. packaged in polythene bags and labeled for Atomic Absorption Spectrophotometer analysis.

Usually the apparatus consists of a light source, a sample-atomizer, a spectroscope and a photometer and a recording system. Some are equipped with a back ground compensation system. For the light source, a hollow cathode lamp and a discharge lamp are mainly used. To the sample atomizer, the flame type, electro-thermal type and the cold vapor type are applied Co-precipitation method can be used by taking combination of 2-mercaptobenzothaizole as a chelating reagent and copper as a co-precipitate carrier was used for the determination of trace lead in various samples by graphite furnace atomic absorption spectrometry. The method is used for the determination of lead in grass and rice samples.

Sampling Method

Water samples (500 ml) are filtered using whatman No. 41 (0.45 micrometer pore size) filter paper for estimation of dissolved metal content. Filtrate and as collected water samples (500 ml. each) are preserved with 2 ml. nitric acid to prevent the precipitation of metals. Both the samples are concentrated to tenfold on a water bath and subjected to nitric acid digestion using microwave assisted technique, setting pressure at 30 bar and power at 700 watts.

Soil samples are air dried and ground into fine powder using pestle and mortar and passed through 1 mm sieve. Well mixed samples of 2 g each are taken in 250 ml glass beakers and digested with 8 ml of aqua regia on a sand bath for 2 hours. After evaporation to near dryness, the samples are dissolved with 100 ml of 2% Nitric acid filtered and then diluted to 50 ml. with distilled water.

Grass feed sample of 2.5 g was treated with 25 ml of concentrated HNO_3 and digested for 30 to 45 minutes, after cooling the solution, add 10 ml of $HClO_3$ to the mixture and the digestion was continued till the colourless solution was obtained. The resulting solution was made upto the mark. Milk samples of 5 ml was taken in a 100 ml volumetric flask and TCA (25%) was added and mix upto the mark with deionized water. The flask was shaken for 15 minutes and filtered 5 ml of this a liquid was transferred to 50 ml volumetric flask and 1 ml of 5% lanthanum oxide solution was added. Finally it was made upto 50 ml.

Alternate Method

Milk samples of 250 ml are taken in 500 ml glass beakers and digested in 24 ml of Aquaregia on a sand bath for 3 days. After evaporation to a lesser volume the samples are filtered and diluted to 50 ml with distilled water (6, 7, 8).

RESULTS AND DISCUSSION

The aim of the study is to assess the extent of heavy metal contamination (mainly lead) with sewage fed Musi water. Samples of water, soil, fodder grass, milk is to be analyzed for lead using atomic absorption spectrophotometer. Eight places were recognized along with stretch of Musi River viz., Gandipet, Musarambagh, Uppal, Choutuppal, Sopet, Suryapet and Nandigama for the sample analysis. Water, Soil, Fodder, Milk samples will be tested in these eight places on monthly basis and continued for 36 months. Comparison will be done for water, soil, fodder, milk samples region wise, season wise. Region wise comparison will be done due to more number of paint, dye, pharmaceutical and chemical industries are located in certain areas. Seasonal comparison is due to flow of river will vary in different seasons. In rainy season rainfall will be more; heavy metal concentration will get diluted. More emphasis will be given to milk samples because it will directly damage the health of human kind.

Milk samples from the distant areas of Musi River will be tested and compared with milk samples of nearby areas of Musi River.

It is observed that Choutuppal soil has all lead value over 0.733g/ml, soil excretion of this metal was significantly higher in statistical terms ($p < 0.05$).

Table 1 Mean values of lead level in blood and milk of cattle reared

LOCATION	LEAD (Gg/ml)			
	Water	Soil	Fodder Grass	Milk
Gandipet	0.98	0.289	0.038	0.027
Musarambagh	0.522**	0.654**	0.181	0.198
Uppal	0.704***	0.632***	0.269**	0.315**
Choutuppal	0.684***	0.773***	0.652***	0.601***
Sopet	0.414*	0.384*	0.102	0.132
Suryapet	0.208*	0.355*	0.411**	0.496**
Nandigama	-	-	-	-

* p>0.05 – not significant differences
** p<0.05 - significant differences
*** p <0.01 - significant distinct differences

Regarding the determination of lead in the area of Gandipet, Musarambagh, Uppal, Choutuppal, Sopet, Suryapet and Nandigama it was observed that the mean fodder and milk levels of lead was significantly higher (0.652Gg/ml and 0.601Gg/ml) to the maximum allowed limit, which contributed to a distinct increase significantly ($p<0.01$) average value of this heavy metal in water and soil (0.773Gg/ml and 0.704Gg/ml).

CONCLUSIONS

High levels of lead are found in water, soil, fodder particularly near the industrial areas in and around Hyderabad has the influence to reach and accumulate in the livestock which may cause severe human health hazards.

Higher levels of lead and other metals found in the water milk and soil in different areas Hyderabad is a serious concern. Presence of lead metal at toxic levels has been reported from Hyderabad and other areas in livestock. The higher level of heavy metal content was found in Choutuppal Soil and Uppal Water due high contamination of industries indicating the effect of pollution in the livestock. The overall situation of lead metal pollution in the environment and in livestock and products are alarming. This is high time for state agencies to be concern about the heavy metal pollution and its consequences on the livestock and human health for necessary control measures.

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