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STUDY OF HEAVY METALS ANALYSIS IN MUNCIPAL SEWAGE WATER OF WARANGAL (WMC)

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ABSTRACT

In this study an attempt to know the concentration of heavy metals in sewage water in and around Greater Warangal City. For this study 10 sewage water samples were collected in between May-July 2017. Samples were acid digested using hot plate with HNO_3 and HCL (1:1) ratio. Samples keep at -4^{o}C Temperature prior to analysis. These samples were analysis for six elements like Cd, Cr, Cu, Ni, Pb and Zn by using SHIMADZU AA-6300 Atomic absorption spectroscopy. It is one of the most important techniques for analysing heavy metals in parts per million (PPM) level. This study Cd is ranging from 0.043-49 Mg/L, Cr is varied between 0.38-3.86 Mg/L, Cu is ranging from 2.44-22 Mg/L, Ni is varied between 0.3-5.38 Mg/L, Pb is ranging from 0.078-5.97 Mg/L and Zn is 1.5-24.11 Mg/L. The concentration of these metals in this study area was compared with sewage water quality limits given by IS: 2490 And world health organization (WHO) guide lines.

KEY WORDS

Sewage water, Metal ions, WMC, AAS.

INTRODUCTION

Warangal is the second largest city of Telangana State with a population of about ten lakhs. Warangal is located at 18.0° North Latitude and 79.58° East Longitude and has an average elevation of 302 meters (990 feet). It is a tri-city, Warangal is a cluster of three towns: Warangal, Hanamkonda and Kazipet, with a common civic administration i.e. Warangal Municipal Corporation (WMC). Heavy metal contamination affects large areas worldwide. Hot spots of heavy metal pollution are located close to industrial sites. Agriculture in these areas faces major problems due to heavy metal transfer into crops and subsequently into the food chain. Heavy metals have been shown to mainly enter the human body through food and water and are known to have serious health implications (1).

Accumulation of heavy metals (HMs) in natural ecosystems poses threats to human health and biodiversity due to their persistence and toxicity (2-6). Worldwide, coastal and marine ecosystems are subject to HM pollution from municipal wastes and runoffs from agriculture and industrial sources. (6-9).

Heavy metals are generally considered those whose density exceeds 5 g per cubic centimetre. Most of the elements falls into this category are highly water soluble, well-known toxics and carcinogenic agents (10). Heavy metals with adverse health effects in human metabolism (including lead, mercury, cadmium and arsenic) present obvious concerns due to their persistence in the environment and documented potential for serious health consequences. Acute heavy metal intoxications may damage central nervous function, the cardiovascular and gastrointestinal (GI) systems, lungs, kidneys, liver, endocrine glands, and bones (11).

Although it is acknowledged that heavy metals have many adverse health effects and last for a long period of time, heavy metal exposure continues and is increasing in many parts of the world. Heavy metals are significant environmental pollutants and their toxicity is a problem of increasing significance for ecological, evolutionary, nutritional and environmental reasons (12-13).

MATERIALS AND METHODS:

Materials:

The samples were collected from different sites at different time intervals like, in the month of May and July 2017. All chemicals and reagents are used in this study were of analytical and grade. 65 % HNO_3 (Nitric acid), 37 % HCL (Hydrochloric acid) and dH_2o (pH 6.5±7.0) obtain from zeal chemicals & Co.,

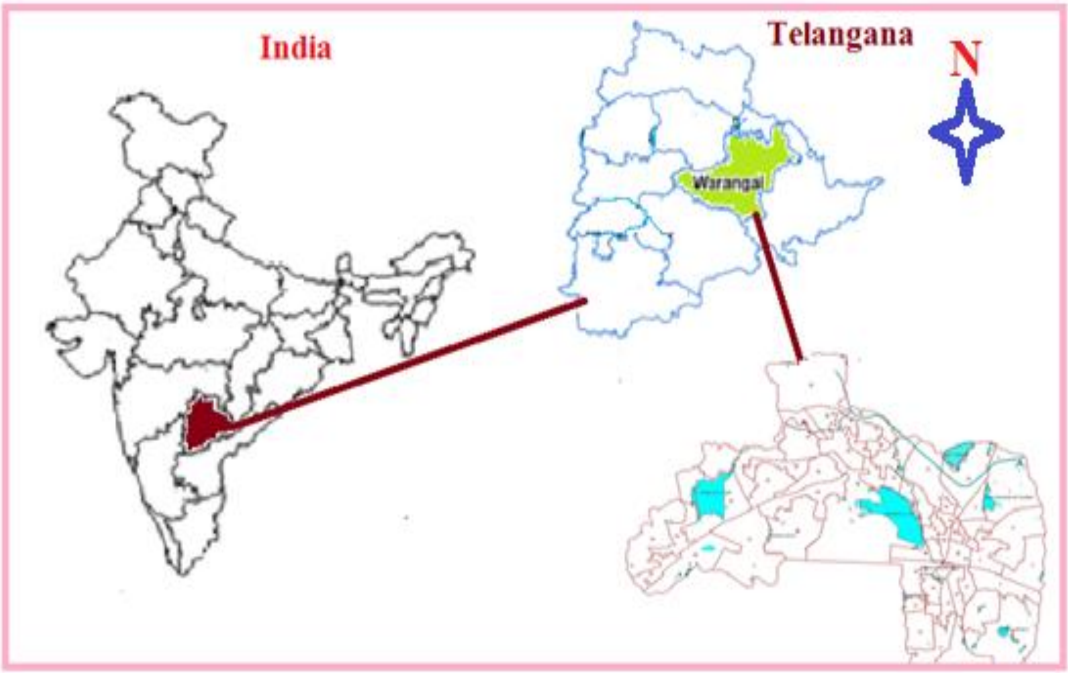

Fig. 1 Map showing study area

Method:

Acid-digestion method fallowed according to (Ang H, Lee K., 2005). From the 1 Litre Sample 100 mL of sewage water sample was placed in 250 mL beaker add 10 mL of freshly prepared acid mixture of 65 % HNO_3 and 10 mL of 37 % HCL was added. Then, the mixture was heated gently over a Hot plate (95 °C ± 5 °C) for 2 h or (until the sample had completely dissolved) (Ang H, Lee K., 2005). Then cool at room temperature the sample volume is reduced up to 20-30 mL. During the digestion procedures, the inner walls of the beakers were washed with 2 mL of deionized water to prevent the loss of the sample, and at the last part of the digestion processes, the samples were filtered with Whatman 42 (pore sized) filter paper. Then, a sufficient amount of deionized water was added to make the final volume up to 100 mL. Method was performed in triplicate for each sample. Keep samples at -4 °C until analysis. Samples analysed by using Atomic absorption spectroscopy (AAS).

RESULTS AND DISCUSSIONS:

Cadmium (Cd):

Cadmium (Cd) is produced by several industrial processes such as protective coatings (electroplating) for metals like iron, preparation of Cd-Ni batteries, control rods and shields within nuclear reactors and television phosphors. The chronic effects of Cd consist of lung cancer, pulmonary adenocarcinomas, prostatic proliferative lesions, kidney dysfunction, bone fractures, and hyper- tension (15). In our sample during the study period 2017 minimum and maximum cadmium levels varied between 0.043 to 49 Mg/L.

Chromium (Cr):

Occupational sources of chromium include protective metal coatings, metal alloys, magnetic tapes, paint pigments, rubber, cement, paper, wood preservatives, leather tanning and metal plating (16). Exposure to higher amounts of chromium compounds in humans can lead to the inhibition of erythrocyte glutathione reductase, which in turn lowers the capacity to reduce methaemoglobin to haemoglobin (17-18). In our sample during the study period the average ranged Chromium is 0.38 to 3.86 Mg/L respectively.

Cupper (Cu):

Copper is used in electronics, plating, paper, textile, rubber, fungicides, printing, plastic, and brass and other alloy industries and it can also be emitted from various small commercial activities and warehouses, as well as buildings with commercial heating systems. When present at low concentrations, Cu causes headache, nausea, vomiting and diarrhoea, and at higher levels of deposition, it leads to liver and kidney malfunctioning (19). In our sample the minimum and maximum concentrations of Copper were 2.44 to 22 Mg/L.

Nickel (Ni):

Nickel (Ni) is discharged into the sewage water by industries like Stainless steel manufacturing units, electroplating factory discharge. Ni is neurotoxic, genotoxic, and carcinogenic agent which may cause a severe health problem like nickel dermatitis. Etc. Humans may also be exposed to nickel by inhalation, drinking water, smoking, and eating contaminated food. Uptake of high quantities of nickel can cause cancer, respiratory failure, birth defects, allergies, and heart failure. In our sample during the study period the Nickel concentrations levels in sewage water locations of study area are varied from 0.3 to 5.38 Mg/L.

Lead (Pb):

Lead is highly toxic and hence its use in various products, such as paints, gasoline, etc., has been considerably reduced nowadays. The main sources of lead exposure are lead based paints, gasoline, cosmetics, toys, household dust, contaminated soil, industrial emissions (20). Lead (Pb) is ubiquitously present heavy metal which is used in paints, storage batteries, and the oxide is used in producing fine crystal glass. Higher levels of Pb lead to cognitive impairment in children to peripheral neuropathy in adults (21). In our sample during the study period the Lead concentrations levels in sewage water locations of study area are varied from 0.078 to 5.97 Mg/L.

Zink (Zn):

Zinc (Zn) is discharged in the Lakes in the form of effluents from electroplating industries, sewage discharge and the immersion of painted idols. Zinc toxicity causes vomiting, diarrhoea, respiratory problems and many health hazards. In our sample during the study period the Lead concentrations levels in sewage water locations of study area are varied from 1.5 to 24.11 Mg/L.

Table 1: Showing concentration of the heavy metals in sample water (Mg/L) at different sites.

S/No.	Name of the Element	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Mean Value	SD	IS:2490 Guidelines for sewage water (2012) Mg/L(23)	WHO Guidelines for drinking water quality (2011) Mg/L(22)
1	Cd	0.11	0.05	0.21	49	1.57	0.10	0.04	0.43	2.15	0.10	5.37	5.37±5.11	1.0	0.01
2	Cr	1.34	0.40	1.14	1.16	1.58	0.36	2.15	3.86	2.53	0.38	1.49	1.49±0.37	2.0	0.05
3	Cu	8.89	3.12	8.97	22	6.16	2.78	2.44	15.45	5.33	6.33	8.14	8.14±2.07	3.0	2.0
4	Ni	3.16	1.80	1.07	0.89	5.38	0.31	0.63	3.67	0.35	0.3	1.75	1.75±0.56	3.0	0.07
5	Pb	3.54	2.33	3.90	2.2	2.96	2.29	2.51	5.97	ND	0.78	2.65	2.65±0.52	1.0	0.01
6	Zn	19.44	11.00	20.08	19	14.04	9.93	3.72	24.11	15	1.5	13.78	13.78±2.02	15	5.0

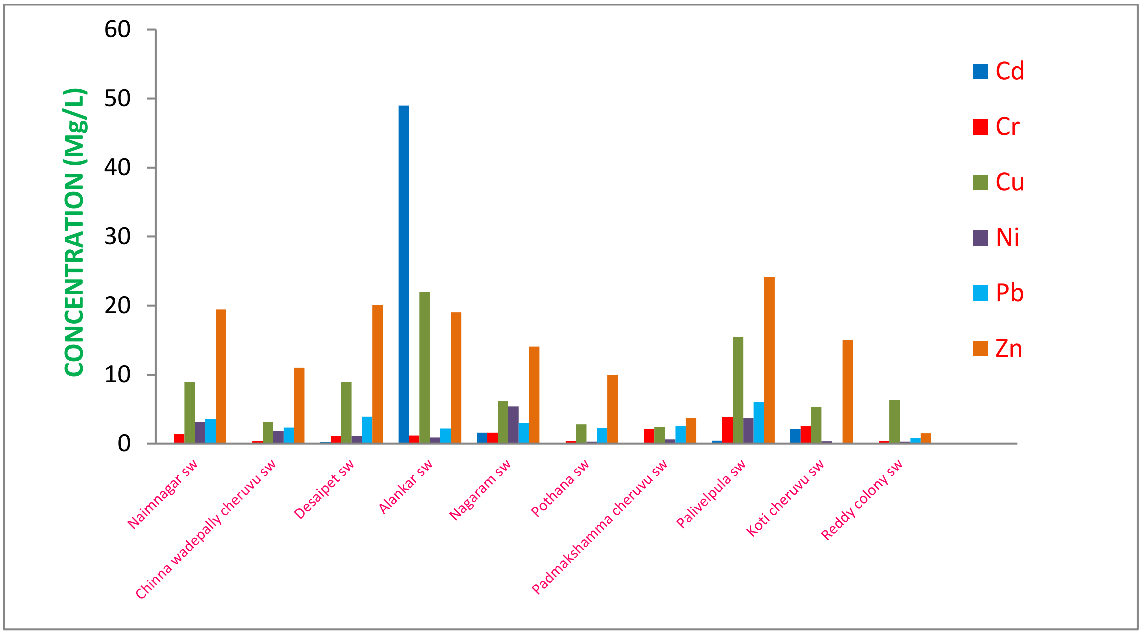

Fig. 2 Graph showing comparison level of concentration of heavy metals in different sites.

CONCLUSION:

Samples were analysed at 10 different places in two months (Fig.2, Table.1). In case of Cd were found these results are high in two sites. This study shows high amount of Cd. Cr is more than Cd in all 10 sites. Cu were more abundant in all sites of sampling. Which more than the standard according IS: 2490. Ni were found frequently observed two to three sites, one of more metal that is Pb also contain in all most all sampling sites. Among all Zn also represent more amount of metallic ions. Over all conclusion of this study denotes that Cu, Zn are more than their required. Most of colouration industries and household wastes were discharged in to this drain which leads to the concentration of Cu, Zn ions. This study reveals that the people who were living nearly the drain effluents are more prone to diarrhoea, vomiting, nausea and kidney problems.

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