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DETERMINATION OF HEAVY METALS ANALYSIS IN SLUDGE WATER OF WARANGAL REGION, TELANGANA.

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Abstract

This study examines the Heavy metals in sludge water of Warangal region. The samples were collected from two selected sites in three seasons (Pre monsoon, Monsoon and Post monsoon) in the month from September 2015 to March 2018. These samples were subjected to analysis for six metal ions like Cd, Cr, Cu, Ni, Pb and Zn. Samples were acid digested using HNO_3, HCL and DH_2O for Hot plate digestion. The samples detected in PPM (parts per million) by using SHIMADZU AA-6300 Atomic absorption spectroscopy. Concentration level of toxic metals fallowed in three seasons. The heaviest concentration was Zn, Cu, Cr, Pb, Cd and Ni. Then samples were compared with Control and WHO for drinking water guidelines.

Key words: Heavy metals, Sludge water, Hot plate digestion, AAS, Warangal region.

Introduction

Water pollution, which creates a major environmental concern of India, is the introduction of contaminating pollutants into the natural water leading to an adverse change. Water, the precious gift of nature to human being is going to be polluted day by day with increasing urbanization. Although three-forth part of earth is being surrounded by water but a very small portion of it can be used for drinking purposes. Ground water is an important source of drinking water for humankind. It contains over 90% of the fresh water resources and it is an important reserve of good quality water. Ground water, like any other water resource, is not just of public health and economic value (Armon et al., 1994).

Rapid Industrialisation and Urbanisation is creating a lot of problems in diverse manners. Primarily, lack of infrastructure and planning wreaks havoc on the environment. Study of water pollution become a research frontier due to the significance of academic, public and political concerns (Ebenstein, 2012; Schwarzenbach et al., 2010; Zhang et al., 2010; Li et al., 2014).

Sewage sludge from municipal wastewater treatment plants contains organic compounds, macronutrients, micronutrients and non-essential trace elements, organic micro pollutants, microorganisms and eggs of parasitic organisms (Alloway and Jackson, 1991). Domestic sludge water is the water which returns after being used by a community for various ways such as personal washing, flushing of toilets, food preparation and cleaning of kitchen utensils. Its characteristics and flow rates can vary depending on the economic status, living conditions of the various communities and water supplies.

During monsoon season due to high water flow through drainages all these toxic materials are leached and dissolved in the sludge water and pollute the aquatic ecosystem. These initiate the development of eco-industrial parks as a way to a more sustainable industrial development (Conticelli and Tondelli 2014).Principal contaminants in domestic wastewater are suspended solids, biodegradable organics, nutrients, toxic compounds, heavy metals, and pathogens (Diaper et al. 2008; Tjandratmadja et al. 2010).Ninety seven percent of the world's water is found in oceans. Only 2.5% of the world's water is non-saline fresh water (Itodo A.U, 2010).

Heavy metals are considered to be one of the main sources of pollution in the environment, because of their significant effect on the ecological quality [Sastre, et, al, 2002]. The major sources of heavy metal pollution in the environment includes man-made effects like, combustion of fossil fuels, mining activities, wastewater discharges of manufacturing industries, and waste disposal (Friberg, et.al, 1986). Levels of heavy metals in the sediments and soils may pass to the aquatic environment, groundwater, and plants through the transfer processes and reach to the animals and humans. Consequence, the use of simple and accurate methods for monitoring toxic metals has a great importance among the environmental pollution studies.

In Various sites of Warangal metropolitan city Sludge water associated metals can be released into the water column and accumulate in plants and animals those are entering in the food web. Recently the aquatic environmentalists mostly concentrate on the research related to the sludge water analysis to know the past and present history of heavy metals pollution and the severances of anthropogenic impact. Today most of the drainages receive million numbers of litres of sewage, domestic waste and industrial effluents containing varying in characteristics from simple nutrient to mostly toxic substances. India has failed in waste management strategies adopted to keep face with the industrial growth and urbanization. That impact on Indian economy holds a double edged sword of economic growth and ecosystem collapse (Priyanka Dhingra, at, al, 2015). Most of the sludge water pollution is caused by the addition of organic and inorganic materials from non-point sources such as sewage, food waste, leather effluent, and domestic wastes, man-made wastes through drainage ditches, including artificial fertilizer residues, insecticides, herbicides, pesticides and paint waste and from point sources such as electroplating, pesticide, fertilizer and beverage industries. All the above point source and non-point source pollutants increase the heavy metals load inside the sewage system. Many research studies have been conducted by the biologists on sludge water to explain different kinds, sources and reasons for pollution. They primarily indicate the urbanization followed by population growth as the main reasons for waste water pollution.

Municipal and Urban development agencies are trying hard to cope with the existing situation with demographics and infrastructure development while the population is still increasing. The most prominent associated problem is that with pollution and waste management Warangal Metropolitan City generates huge amounts of domestic sewage and industrial waste and the most common way of disposal is by landfills and open sewers.

MATERIALS AND METHODS

The samples were collected from different time intervals like Monsoon, Post monsoon and pre monsoon seasons in throughout the year from month of September 2015 to March 2018 at two different sites in and around Warangal Metropolitan City, are followed by 1. Nagaram tank site, 2. Koti pond site.
All chemicals and reagents used in this study were of analytical and trace metal grades. Trace metal grades 65 % HNO_3 (Nitric acid), 37 % HCL (Hydrochloric acid) and Double deionised water (pH 6.5±7.0) obtain from zeal chemicals & Co., hanamkonda, Warangal.

Samples from both the sites were collected in 1litre polyethylene bottles during three seasons of the year from adjoining areas of Warangal City. The samples are properly labelled before collecting and kept in 1 litre polyethylene bottles. Which have been washed two times with sewage water before collecting of sample. The sample bottles were tightly covered immediately. After collection samples brought into laboratory for further investigation.

Method A (nitric acid-hydrochloric acid digestion)

Out of 1Litre, we had taken 100 mL of 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 ºC) for 1-2 h or (until the sample had completely dissolved) (Ang and Lee 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 ºC until analysis

Results and discussion

3.1. Cadmium (Cd):

The pollution of Cd in these sites are plastic, automobile repairing exhausts and other sewage domestic wastes. During study period Cadmium concentration at two sites in three years on seasonal basis ranged between 0.08 to 1.475 Mg/L. The Cd concentration in two sites are excess in Pre monsoon season of 2015-2016, 2016-2017 and Monsoon season of 2017-2018 when compare with Control sample and WHO standards. So, both sites are more concentrated due industrial and domestic sewage effluents.

Chromium (Cr):

The more toxicity of Chromium in these samples due to leather pollution. Chromium pollution in these samples may cause severe health problems. During study period Chromium concentration at two sites in three years on seasonal basis ranged between 0.01 to 3.581 Mg/L. The Cr concentration in two sites are excess in Post monsoon season of 2016-2017 at Nagaram site (3.26 Mg/L) and Pre Monsoon season of 2017-2018 at Koti pond site (3.581 Mg/L). When compare with Control sample and WHO standards more due to pollution of leather.

Copper (Cu):

In the present investigation Nagaram tank site water sample highest amount of Copper was found in Monsoon season of 2016 (19.21 Mg/L) and highest Copper concentration in Koti pond site was Post monsoon season of 2016 (12.46 Mg/L). Both sites are highly compared to Control and WHO Standards. The WHO limit of Copper was 2.0 Mg/L. Plumbing and house hold pipes are major source for Cu Toxicity. Paper waste effluents, textile wastes and printing wastage are major concern with this pollution.

Nickel (Ni):

During study period Nickel concentration at two sites in three years on seasonal basis ranged between 0.04 to 5.151 Mg/L. The Ni concentration in two sites are excess in Pre monsoon season of 2015-2016 at Nagaram tank and Pre monsoon season of 2017-2018 at Koti Pond when compare with Control sample and WHO standards. The Nickel toxicity in these sites are sewage domestic untreated effluents.

Lead (Pb):

In Nagaram tank site water sample the more concentration of Lead was found in pre monsoon season of April 2017-18 (3.156 Mg/L) and more concentration of Lead in Koti pond site was monsoon season of 2015-16 (1.45 Mg/L). It is greatly increased in both sites compare with WHO limits. The WHO limit of Lead was 0.01 Mg/L. Lead pollution due painted idol immersions.

Zink (Zn):

During study period Zinc concentration at two sites in three years on seasonal basis ranged between 1.32 to 19.85 Mg/L. The Ni concentration in two sites are excess in Pre monsoon season of 2016-2017 at Nagaram tank and Pre monsoon season of 2017-2018 at Koti Pond when compare with Control sample and WHO standards. The Nickel toxicity in these sites are sewage domestic untreated effluents.

Table 1: Seasonal variation of heavy metals concentration at Nagaram tank site

Year			2015-2016			2016-2017			2017-2018		
Parameter	Control sample	WHO Limits	Monsoon	Post monsoon	Pre monsoon	Monsoon	Post monsoon	Pre monsoon	Monsoon	Post monsoon	Pre monsoon
Cd	0.10	0.01	0.08	ND	1.475	ND	ND	1.57	0.11	ND	1.101
Cr	1.52	0.05	0.01	2.83	1.59	ND	3.26	1.58	ND	2.63	1.72
Cu	2.11	2.0	10.18	7.52	6.06	19.21	4.63	6.16	10.12	5.91	8.092
Ni	1.32	0.07	0.15	ND	5.151	ND	ND	5.38	ND	ND	3.214
Pb	1.81	0.01	1.52	ND	2.925	1.82	ND	2.96	1.92	ND	3.156
Zn	3.25	5.0	1.92	1.232	15.044	1.32	1.562	14.04	1.81	1.56	12.54

ND=Not detected **WHO (World Health Organization) Limits for drinking water quality (2011) Mg**

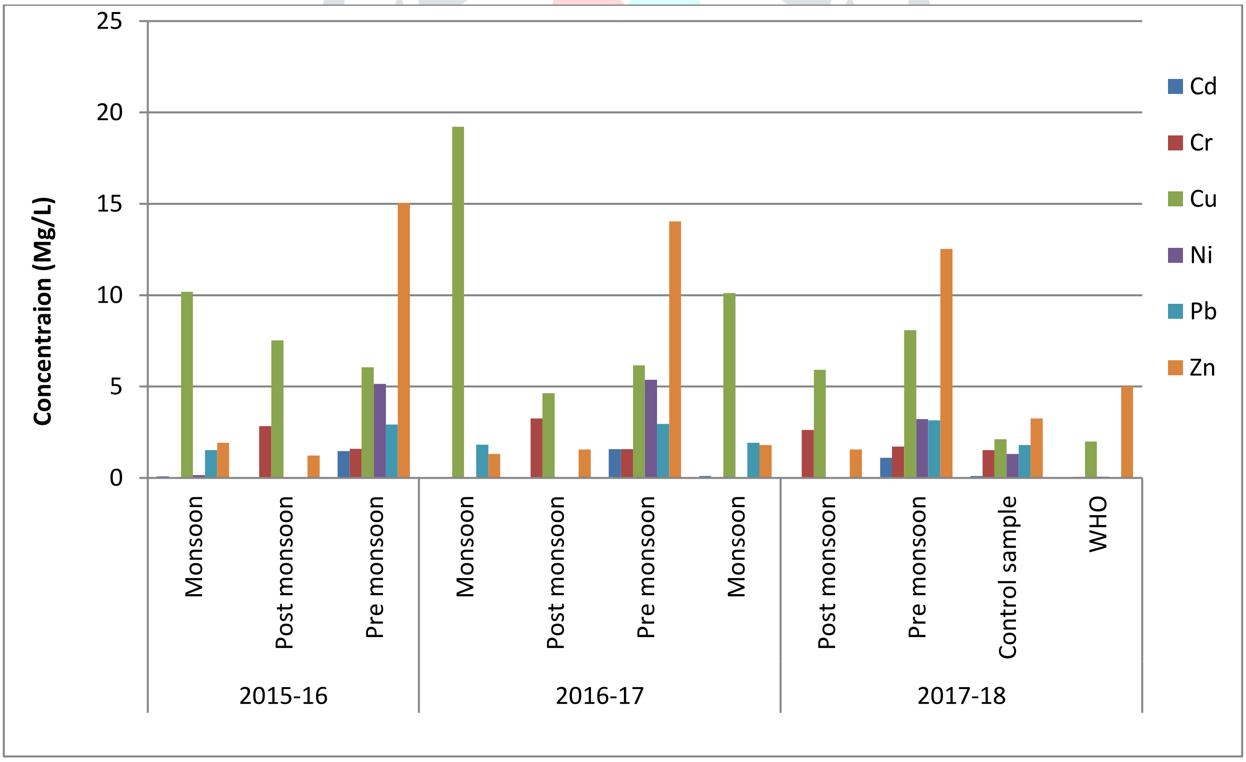

Figure 1. Seasonal comparison of heavy metals concentration at Nagaram tank site

Table 2: Seasonal variation of heavy metals concentration at Koti pond site

Year			2015-2016			2016-2017			2017-2018		
Parameter	Control sample	WHO Limits	Monsoon	Post monsoon	Pre monsoon	Monsoon	Post monsoon	Pre monsoon	Monsoon	Post monsoon	Pre monsoon
Cd	0.23	0.01	0.09	ND	2.55	ND	ND	2.15	ND	ND	2.27
Cr	1.02	0.05	1.59	1.29	2.580	3.01	1.89	2.53	1.56	1.69	3.581
Cu	3.15	2.0	3.87	12.46	5.85	3.92	19.78	5.33	3.41	17.97	4.508
Ni	0.05	0.07	0.04	0.117	0.121	ND	0.152	0.35	ND	0.137	0.369
Pb	0.89	0.01	1.45	0.812	0.01	1.01	0.956	ND	1.12	0.180	1.25
Zn	6.23	5.0	14.32	3.358	15.015	12.94	8.361	15	13.24	3.798	19.85

ND=Not detected **WHO (World Health Organization) Limits for drinking water quality (2011) Mg**

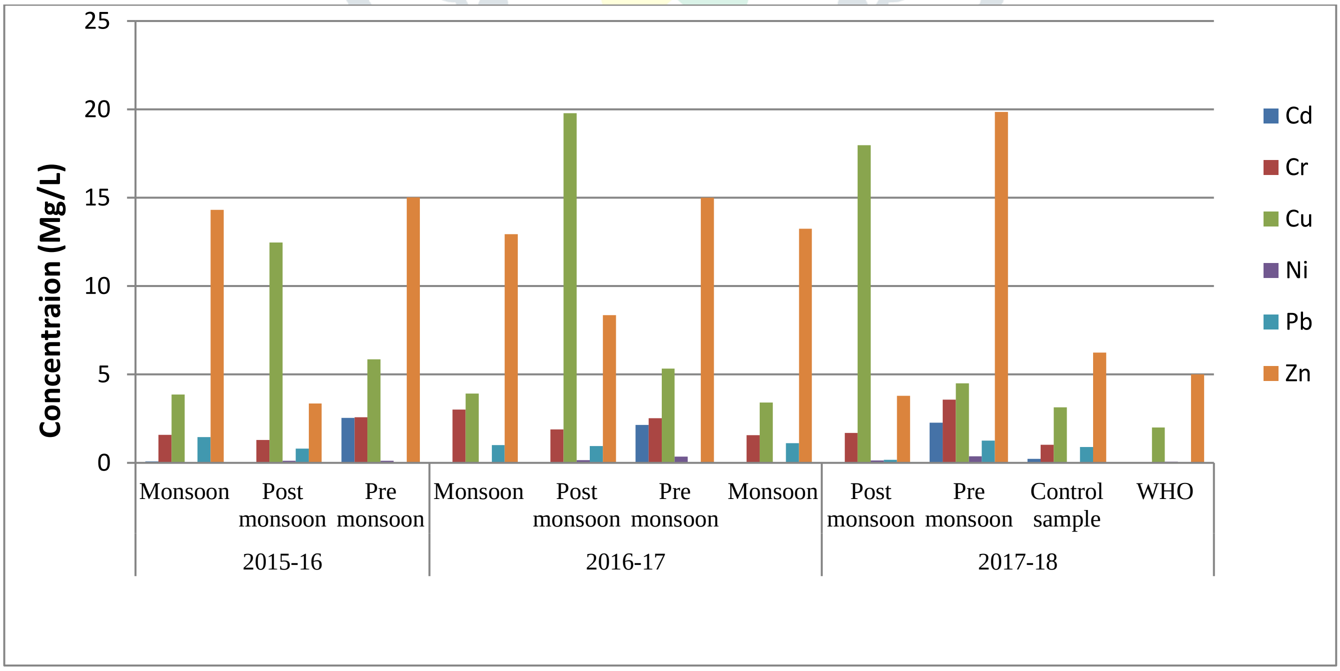

Figure 2. Seasonal comparison of heavy metals concentration at Koti pond site

Conclusion:

The examination of toxic metals in the sludge water of Warangal region is important step for environment and human health. The toxic levels of heavy metals might cause acute and chronic health problems in human beings. The present study investigate six heavy metals like Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Nickel (Ni) and Zinc (Zn) in Warangal Region, Telangana State. In two sites during study period above all the metals are more permissible set by the Control and WHO Standards. This study reveals that sludge water from these sites are highly polluted. There is urgent need to follow adequate effluent treatment methods before their discharge to surface water bodies for reducing their potential environment and health hazards.

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