Assessment of Heavy Metals In Water Samples From Arabian Sea Along West Coast of Maharashtra, India

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Abstract- *Marine environment is constantly being threatened by the release of untreated sewage and industrial effluents which eventually disturbs the sustainability of living resources and public health. These wastes carry massive quantity of toxic contaminants especially the heavy metals that have the tendency to accumulate into the basic food chain and move up through the higher trophic level and results in negative influence on the oceanic resources. The present study was conducted to assess heavy metal concentrations in water along Arabian Sea, west coast of Maharashtra, India by using ICP-AES (Inductively Coupled Plasma- Atomic Emission Spectroscopy). The concentration of estimated metals, Cu, Cd, Pb and Zn in the present study were below the standard permissible limits in sea water collected from Sassoon dock, Mumbai Coast of Maharashtra during three different season of the year 2016-18.*

Keywords- Arabian Sea, heavy metals, ICP-AES, Sassoon dock.

I. INTRODUCTION

Heavy metals are one of the severe pollutants in natural environment due to their toxicity, persistence and bioaccumulation problems (Pekey, 2006; Nouri et al, 2006). Release of toxic substances has harmful effects on the natural environment, human health and agricultural efficiency (Gadzała-Kopciuch, 2004). In coastal environments and estuaries, which are often characterized by large industrial clearances and urban areas, the impact of effluent discharges leads to the accumulation of heavy metals (Ridgway and Shimmield, 2002). The aquatic environment through its water quality is reflected to be the most important factor for controlling the health and disease instance in both human being and animals (Rashed, 2004). Currently, the increasing use of the chemical wastes and agricultural drainage systems represents the most hazardous form of chemical contamination mostly heavy metal pollution. Environmental pollution by heavy metals is a worldwide problem because these metals are persistent and have toxic effects on living organisms when they exceed a certain concentration (Chakraborty*et al*, 2009).The most important heavy metals that cause water pollution include Zinc, Copper, Lead and Cadmium (Rashed, 2004). The addition of metals in a marine environment has direct consequences to human being as wellas the ecology. Coastal areas are some of the supreme sensitive environments and so far they are theme to growing human pressures (David, 2003) for the reason that of increasing urbanization and industrial development. Hence, pollution levels are repeatedly increased in the coast due to the nearby land-based pollution sources (Fergusson, 1990; Wang, et al., 2007). Almost all industrial practices that produce waste discharges are potential sources of heavy metals to the aquaticbodies (Denton, et al., 2001). Heavy metals are considered to be key toxicant in polluted water globally (Asonye et al., 2007 and Yasuhiro et al., 2007).

By looking at the increasing concern towards heavy metal toxicity in the marine environment and its bioaccumulation properties in fishes it has become extremely important to keep a continuous check on marine ecosystem. Thus, the present study was carried out to evaluate the level of heavy metals (Cd, Cu, Pb and Zn) contamination in water samples of the Arabian Sea collected from Sassoon dock, west coast of Maharashtra and to have a clear picture of the heavy metals pollution.

II. MATERIALS AND METHODS

Water samples were collected fromSassoon dock during three different season of the year 2016-18. Samples were collected using polyethylene bottles, which was pre-washed with 10% nitric acid and de-ionized water. Before sampling, the bottles were rinsed at least three times with water from the sampling location. The bottles were immersed to about 20-40 cm below the water surface to prevent contamination of heavy metals from air. Water samples were immediately brought to the laboratory where they were filtered and used for heavy metal estimation. The estimation of heavy metals, Pb, Cd, Cu and Zn from water samples were done using ICP-AES method. Further the concentration of metals in water samples were compared with safety guidelines proposed by FAO/WHO (1989) for sea water.

III. RESULTS AND DISCUSSIONS

Heavy metal pollution is a very serious issue in many countries caused by industrial waste disposal into sea, where it becomes toxic for many marine organisms (Velusamy*et al*., 2014). Sea has been recognized as the crucial repository of terrestrial matter including enormous array of manmade chemicals and industrial effluents (Udotong, 2015). The heavy metal concentrations in water samples of Arabian Sea collected from Sassoon dock were estimated during pre-monsoon, monsoon and post-monsoon season of the year 2016-18 and are presented in Table no.1. Copper and zinc are essential metals required by living organisms however lead and cadmium are lethal even in trace amounts (Zhang *et al*.,2007; Bilandzic *et al*., 2011; Alturiqi and Albedair, 2012). Results obtained from the present investigations showed the levels of Cu, Cd, Pb and Zn in water samples collected from Sassoon dock were below the permissible limits (FAO/WHO, 1989) during all three seasons i.e. Pre-monsoon, monsoon and post-monsoon season. Recent studies reveal that the levels of heavy metals in organisms are higher than that of the concentration present in their surrounding water.The natural concentrations of heavy metals in ocean exist very low and consequently the risk of contamination in living tissues is high (Zodape*et al*., 2011). This happens due to the properties of bioaccumulation (Censi*et al*., 2006; Patil *et al*., 2016)and bio-magnification (Kumar and Singh, 2010) in fish organs and eventually threaten the health of human beings by sea food consumption (Zodape *et al*., 2011).Thus even though the amount of heavy metals in water samples were below the permissible limits (table.1) the presence of metals may accumulate in the tissues of aquatic organisms thereby causing harm to not only the organisms but also to entire food chain. Oza A and Muralidharan L 2019 reported levels of heavy metals in liver tissues of *Harpodon nehereus* to be more than the standard permissible limits during post-monsoon season. They also reported structural alteration in liver tissues due to accumulation of metals in liver tissues of fish collected from Sassoon dock. Oza A and Muralidharan L 2018 observed high levels of lead in tissues of *Harpodon nehereus*collected from Sassoon dock during pre-monsoon and post-monsoon season in their study carried out during the year 2016-18. These studies clearly indicate that the level of heavy metals in fish tissues is higher than that of their concentration in water.

In the aquatic ecosystems, these toxic metals are passed by way of the food chain to the upper tropic levels and generate vital ecological problems (Shaikh and Nisar, 2018). Thus it has become extremely essential to continuously keep a check on pollution in the marine environment. The results from the present investigation provide first-hand information regarding the concentration of heavy metals in the water samples collected from Sassoon dock.

IV. FIGURES AND TABLES

Table 1: Concentration of heavy metals in sea water (Arabian Sea) collected from Sassoon dock, west coast of Maharashtra during three different season of the year 2016-18

Seasons	Pre-monsoon (summer)	Monsoon(rainy)	Post-monsoon (winter)	Standard limitsFAO/WHO (1989)
Cd (mg/l)	ND	ND	ND	0.01
Cu (mg/l)	ND	ND	ND	10 to 100
Pb (mg/l)	ND	ND	ND	0.05
Zn (mg/l)	0.025 ± 0.003	ND	0.058 ± 0.002	30 to 100

Table values are expressed as mean ± standard deviation
ND means less than 0.01 mg/l

Figure 1: Map showing the location of Sassoon Dock, West Coast of Maharashtra

V. CONCLUSION

The above results and observations clearly indicate that the water collected from sites of Sassoon dock was found to be within the standard permissible limits for sea water proposed by World Health Organization (WHO, 1989). Although the water from the studied site has less heavy metal contents, attention should be drawn towards the bioaccumulation property of heavy metals in aquatic organisms which may cause high health risks to the food chain. Further studies should be conducted to have more clear view on pollution stress in marine environment and its effect on aquatic creatures.

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