HEAVY METALS DISTRIBUTION AND ACCUMULATION IN WATER AND *CYPRINUS CARPIO* IN GUDILUM RIVER CUDDALORE, SOUTH EAST COAST OF TAMIL NADU, INDIA

R.Mohanambal,[*] R.Aasha Madiq[1], K.Jayachandran[2], M.Susiladevi[3], and B.Jeevarasika[4]

*PG & Research Department of Zoology, Thiru Kolanjiappar Govt.Arts College, Vriddhachalam Tamil Nadu, India
[1]Department of Biotechnology, AVC College (Autonomous), Mannampandal,Mayiladuthurai, Tamilnadu, India
[2]Department of Zoology, Annamalai University, PG Extension Centre, Villupuram Tamilnadu, India
[3]Department of Zoology, Immaculate College for Women, Chinnakanganamkuppam,Cuddalore Tamilnadu, India
[4]PG & Research Department of Zoology, Thiru Kolanjiappar Govt.Arts College, Vriddhachalam Tamilnadu, India

Abstract

An investigation was carried out from January 2022 to December 2023. To assess the concentrations of heavy metals such as Hg, Pb, Cd, Cu, and Zn from three separate stations in the Gudilum river, Cuddalore, and to estimate the accumulation of heavy metals in the *Cyprinus carpio* fish that lives in the river. The following is the order of the rates of heavy metal accumulation in the selected tissues. Cu is followed by Zn, Pb, Cd, and Hg.Stations II and III, which are close to the SIPCOT industrial complex, detected higher levels of heavy metal. The findings are discussed in depth.

***Key words**:* Gudilum river, Accumulation, *Cyprinus carpio,* Heavy metals.

***Corresponding author:**
Assistant Professor in Zoology
PG & Research Department of Zoology
Thiru Kolanjiappar Govt.Arts College
Vriddhachalam
Tamil Nadu, India

1. Introduction

The aquatic ecosystem has been contaminated since last two decade and the major reasons of this situation are industrial, agricultural and municipal effluents produced by human activities (Paul and Meyer, 2001). Due to this the aquatic organism are now affected severely, to determine the toxicity it is inevitable to know the aquatic status of organism where the pollutants been highly accumulated. Fish is highly nutritious and major alternatives during this scarcity of food. Fish has been proved a successful tool for biomonitoring of aquatic pollution as it concentrates pollutants in their tissue directly from the water and food (Fisk *et al.,* 2001; Boon et al., 2002). Heavy metals are serious pollutant in the aquatic animals and human. Even though some metals are necessary for life in low quantity and lack of them influence man's health but are poisonous in higher concentration. It is important to monitor the concentration of heavy metals in water, sediments and organisms in order to control and manage the contamination in environment (Madadi, 2008).

Fish constitutes an important and cheap source of animal protein to human being and a large number of people depend on fish and fishing activity for their livelihood. Due to intensive development and urban activities along our rivers, lakes and seashores thousands of new compounds and organic chemicals including trace and heavy metals are being deposited into the natural water bodies (Nagpur *et al*., 2007). Some of these metals are biologically essential but some of toxic to the plants and animals. The danger of these heavy metals is their persistent nature when they are released in to the environment they remain in the biota for very long period (Bolormaa et *al*., 2006). It has been realized that although the aquatic organism are killed with the lethal dose of heavy metals, most of the animals tolerate low concentration of these metals. Moreover the aquatic animals exposed to low levels of heavy metal pollutants accumulate and incorporate significant concentration of such metals in their tissues. The human health hazard linked to the consumption of heavy metal contaminated fish

is of great concern. The present investigation was carried out to assess the heavy metal status as of Gudilum river, Cuddalore.

2. Materials and method

2.1.Study Area

The Gudilum river situated in Cuddalore (Lat, $11^0$43'N, Long, 79^0 49'E) on the South east cost of India. Cuddalore is a semi urban area situated at 200 km to the south of Chennai city.

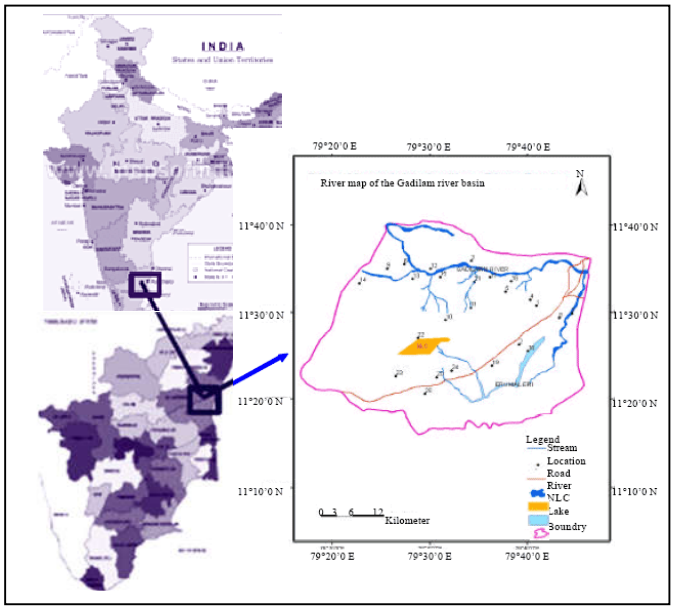

Fig: 1 Study area map

2.3. Sampling station

Three sampling station (Station I, II and III) were selected to study the pollution impact of the Gudilum river. Regular monthly collections of samples for the present study were made for a period of one year from January 2022 to December 2023. Covering Premonsoon (July to September), Monsoon (October to December), Post monsoon (January to March), summer (April to June).

2.4. Heavy metal analysis of water sample

Water samples were analysed the heavy metals (Cd, Cu, Pb, Hg, Zn) by using flame atomic absorption spectrophotometer (Perkin-Elmer model a analyst and varian AA-575).

2.5. Statistical analysis

The data obtained were subjected to analysis of variance (ANOVA) using SPSS 10.0 package to check the effect of season and station sampling.

3.Results and Discussion

Table: 1 Variations of heavy metals in the surface water of Gudilum river , Cuddalore.

Parameters	Station I	Station II	Station III
Cadmium	0.14±0.004	1.71±0.057	0.97±0.0488
Copper	2.09±0.105	8.19±0.4314	5.77±0.240
Lead	0.98±0.053	1.65±0.083	1.54±0.093
Mercury	0.03±0.001	0.12±0.008	0.05±0.004
Zinc	4.32±0.199	21.51±1.848	18.48±1.314

Table: 1 Cadmium, Copper, Lead, Mercury and Zinc content in gill, liver and kidney (mg/g) at the three stations .

Organs	Stations I					Stations II					Stations III				
	Cd	Cu	Pb	Hg	Zn	Cd	Cu	Pb	Hg	Zn	Cd	Cu	Pb	Hg	Zn
Gill	0.04	2.68	2.27	0.12	9.58	3.31	44.62	17.30	4.05	57.05	2.47	43.41	14.72	56.12	57.76
Liver	0.04	12.50	2.22	0.04	14.03	3.39	91.72	18.58	7.04	93.92	2.90	92.63	17.21	7.27	18.44
Kidney	0.06	12.59	0.62	0.10	12.10	0.42	65.76	3.25	4.21	19.53	3.50	62.73	3.00	4.24	18.54

Industrial, agricultural and domestic wastes pollute the water body with heavy metals which reach the human tissues through food chain. In the present study, an attempt has been made to assess the presence of metal such as Cd, Cu, Pb, Hg and Zn in different tissues of *Cyprinus carpio.* The animal average heavy metal concentration in water and accumulation in selected tissues of *Cyprinus carpio* represented in (Table 1 and Table 2).

The more accumulation of cadmium was observed in the gill of *Cyprinus carpio.* The increased of cadmium in gill due to the most permeable region of body and respiration in addition to transport ions during osmoregulation. The accumulation of cadmium in liver was less when compared to kidney. Since liver play an important role in detoxification process, metal elimination may be enrouted through liver as suggested by Dinesh and Madhu, (1998). The kidneys also accumulate the more amount of cadmium. The increased cadmium accumulation in liver tissues may reflect the elevated level of cadmium in water. Gills are accumulate the more amount of copper. The enhanced accumulation of copper in the gills may be due to the mucus layer covering the organ and its close contact with surrounding water. Accumulation of copper high in liver and this may due to its functional importance in

the biological system. Kidneys also accumulate the copper in high quantity. Because the kidney is a major target organ to metal accumulation (Ayyadurai *et al*., 1994).

Gills of *Cyprinus carpio* accumulate the excessive amount of lead. Gill covers more than 60% surface area of the fish and also its external location renders most vulnerable target organ for the pollutants. Liver also more amount of lead accumulate than the gill. Among the organ studied, kidney accumulates least amount of lead. Because the kidney was an important target organ for lead accumulation. Mercury accumulation was more in gill at station II and station III. Because gill was the major site of uptake of metals from water as reported by Jenning and Rainbow, (1973). Liver showed higher concentration of mercury accumulation. The increased accumulation of mercury in liver may be due to the detoxification of metal through liver. Kidney is target organ for mercury toxicity. Hg accumulate at a higher level in kidney, since this organ is route for excretion by which most of the organ excreted and for this reason kidney consider as a target organ to metal. Zinc tend to concentrate more in the gill than in any other organ of *Cyprinus carpio.* Enhanced accumulation of zinc in fish gill form the primary route for metal uptake. The accumulation of zinc was more in liver. This may be due to the uptake and storage of these essential trace elements. In kidney the zinc accumulation level is very less than gill and liver.

4. Conclusion

Anthropogenic activities dumped massive amounts of residential garbage, in addition to municipal sewage, into the river, disrupting the riverine environment. This might be due to increased population and development, making it more polluted. Cuddalure's corporate authority should take appropriate actions to limit pollutants at the source and treat sewage water fully without any direct discharge into water bodies. Residents in the vicinity should also be more devoted to preserving the quality of the river waters.

References

1. Bolormaa , O., Baasansuren, J., Kawasaki, W.M. and Hattori, T.2006. Analysis of heavy metals in water samples from a mining area in magnolia. *Journal of nuclear instrument and methods in physics research.* **243**(I): 161-166.

2. Nagpure, N.S., Kumar, R., Kushwaha, B., Singh, P.J., Srivastava, S.K. and Lakra, W.S. 2007. Genotoxicity Assessment in Fishes a Practical Approach. National Bureau of Fish Genetic Resources, Lucknow, India. 126 pp.

3. Dinesh Barber and Madhu Sudan and Sharma. 1998. Experimentally Induced Bioaccumulation of cadmium in fresh Fish. *Poll, Res*. **17**(2): 99-104.

4. Ayyadurai, K., C.S. Swaminathan and V. Krishnasamy. 1994. Studies of Heavy metal Pollution in the fin fish, *Oreochromis mossambicus* from river Cauvery. *Indian J. Environ. Hlth.*, **36**(2), 99-103.

5. Jenning, J.R. and P.S. Rainbow, 1979. Studies on the uptake of cadmium by the crab *Carcinus maenas* in the laboratory.1. Accumulation from seawater and a food sources. *Mar. biol*., **50**: 131-139.