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ORIGINAL RESEARCH ARTICLE

Distribution and Accumulation of Heavy Metals in Water and *Chanos Chanos* In Gadilum River Cuddalore, South East Coast of India

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ABSTRACT

A study was conducted between January 2011 to December 2011. To determine the heavy metals concentration like Hg, Pb, Cd, Cu and Zn from three different stations in Gadilum River, Cuddalore and also estimated the accumulation heavy metals in the *Chanos chanos* fish inhabiting in the river. The rates of heavy metal accumulation in the selected tissues are the following order. Cu > Zn > Pb > Cd > Hg. The higher level heavy metal recorded in stations II and III which are near to SIPCOT industrial complex. The results were discussed in detail.

Key words: Gadilum River, Accumulation, *Chanos chanos* and Heavy metals.

1. INTRODUCTION

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. 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 [1]. 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 [2]. 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 Gadilum river, Cuddalore.

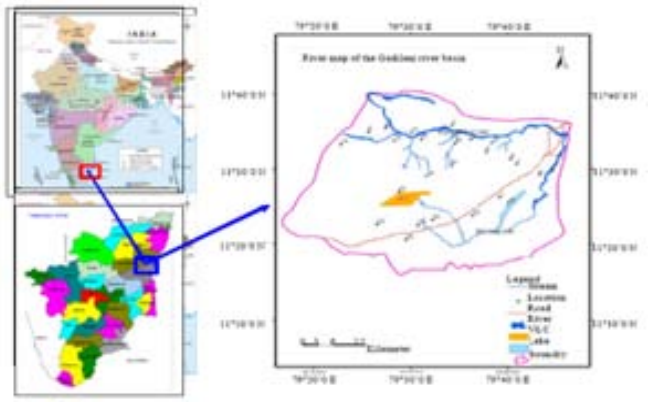
2. MATERIALS AND METHODS

2.1. Study Area

The Gadilum 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.

2.2. Sampling station

Three sampling station (Station I, II and III) were selected to study the pollution impact of the Gadilum river. Regular monthly collections of samples for the present study were made for a period of one year from January 2011 to December 2011.



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Covering Premonsoon (July to September), Monsoon (October to December), Post monsoon (January to March), summer (April to June).

2.3. 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).

2.4. 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. RESULT AND DISCUSSION

Table: 1 Variations of heavy metals in the surface water of Gadilum River, Cuddalore

Parameters	Station I	Station II	Station III
Cadmium	0.12±0.005	1.41±0.056	0.97±0.0485
Copper	2.08±0.105	7.19±0.4314	5.76±0.230
Lead	0.88±0.053	1.65±0.083	1.55±0.093
Mercury	0.02±0.001	0.12±0.008	0.05±0.004
Zinc	3.31±0.199	20.51±1.846	16.39±1.311

Table: 2 Cadmium, Copper, Lead, Mercury and Zinc content in gill, liver and kidney (mg/g) at the three stations

Organs	Station I				
	Cd	Cu	Pb	Hg	Zn
Gill	0.04	2.68	2.27	0.12	9.58
Liver	0.04	12.50	2.22	0.04	14.03
Kidney	0.06	12.59	0.62	0.10	12.10
Organs	Station II				
	Cd	Cu	Pb	Hg	Zn
Gill	3.31	44.62	17.30	4.05	57.05
Liver	3.39	91.72	18.58	7.04	93.92
Kidney	0.42	65.76	3.25	4.21	19.53
Organs	Station III				
	Cd	Cu	Pb	Hg	Zn
Gill	2.47	43.41	14.72	56.12	57.76
Liver	2.90	92.63	17.21	7.27	18.44
Kidney	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 *Chanos chanos.* The animal average heavy metal concentration in water and accumulation in selected tissues of *Chonos chonos* represented in (**Table 1 & Table 2**).

The more accumulation of cadmium was observed in the gill of *Chanos chanos.* 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, [3]. 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 were accumulated 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 [4].

Gills of *Chanos chanos* 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, [5]. 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 tends to concentrate more in the gill than in any other organ of *Chanos chanos.* 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

Huge quantities of domestic wastes were released through anthropogenic activities in addition to municipal sewage which dump into the river and disturb the riverine ecosystem. This may be due to high population and industrialization, so it is more polluted. The corporation authority of Cuddalore should take proper steps to control the pollutants from source and to treat the sewage water completely without any direct discharge into the water bodies. The area residents also should be

more committed to maintain the quality of the river waters.

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