International Journal of Basic and Applied Biology
Print ISSN: 2394-5820, Online ISSN: 2349-2539, Volume 2, Number 4; January-March, 2015, pp. 210-212

http://www.krishisanskriti.org/ijbab.html

Study of Heavy Metal Accumulation in Fish Organs

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Abstract—*Heavy metal assessment is an important exercise to evaluate the nature and extent of pollution in order to take appropriate control measures.Idol immersion activities during certain festive occasions are adding pollution load to the water-bodies. Non-biodegradable materials and synthetic paints used for making these idols are posing serious threat to aquatic life and environment. The present work is concern about the heavy metalevaluation in fish organs (Liver , Kidney, Gills and Abdominal Muscles)Pre-immersion, during immersion and post-immersion .Fish sample were collected from lake and analyzed for concentration of Cadmium by spectroscopic technique. Different organs show different level of exposure to Cadmium. It was observed that the concentration of Cadmium metal significantly increased during and post immersion period.*

Keywords*: Heavy Metal, Fish, Festival Period,Spectrophtometry*

1. INTRODUCTION

The aquatic environment with its water quality is considered the main factor controlling the state of health and disease in both cultured and wild fishes. Pollution of the aquatic environment by inorganic and organic chemicals is a major factors posing serious threat to the survival of aquatic organisms including fish.

Varal Devi lake situated at Dhamankarnaka,Bhiwandi city , District Thane, Maharashtra, India is selected for this research problem. The water from this lake is used for the purpose of drinking and domestic uses and for fishing.This lake water is also a source of edible fishes. The impact of idol immersion activity on the Oreochromis Niloticus fish which is mainly dominating and consumed fish species in Bhiwandi city is studied.

Heavy metal pollution is one of the major types of common toxic pollutants in surface water. These metals are among the major contributors to the pollution of natural aquatic ecosystems [2].Because of their chemical stability, heavy metals tend to accumulate into the tissues of different organisms.Unfortunately,aquatic organisms can be exposed to extremely high levels of these heavy metals. Significant changes in external features and behavioral activities can be observed as a result of heavy metal pollution. The liver is one of the most susceptible organs to the harmful effects of heavy metals, because it is a detoxification organ and is essential for the metabolism and the excretion of toxic substances [2].

Cadmium is one of the most deleterious heavy-metal pollutants in aquatic systems, and exposure leads to severe consequences, such as anemia and emphysema .Various evidence indicates that the toxicity of cadmium may be associated with oxidative damage from the production of reactive oxygen species [2].

The levels of cadmium in fish are of considerable interest, because fish consumption is a major source of cadmium intake for the general population. It was found that most of the cadmium in fish tissues is highly absorbable, accounting for approximately 3–8% of the ingested cadmium load in the gastrointestinal tract of humans.Cadmium exposure induced histological changes in kidney and liver of lake water fish (oreochromis Niloticus)[2].

The immersion of idol of Lord Ganesh during month of August to October is a major source of contamination and sedimentation to the Varal Devi lake water. The idol are made up of clay, plaster of paris, cloth, paper wood, thermocol, jute, adhesive materials and synthetic paints etc. Out of the all material used in making the idol, thermocol is Non-biodegradable while paints contain heavy metals such as Manganese,Chromium, Lead, Cadmium ,Copper ,Zinc , Iron and Mercury. The present study was under taken to evaluate heavy metals inthe organs of one of the mainly dominating and highly consumed species of Oreochromis Niloticus fish commonly known as Tilapia..The level of heavy metal Cadmium was determined in the Kidney, Gills, Abdominal Muscle and Liver of fish collected from the lake .The fish was dissected using clean equipments and digested by acid treatment using double distilled water [1, 3].

Cadmium is known as chalocophite element that is found in sulphide deposits like mercury and lead. Igneous rocks contain on an average about 0.14ppm of Cadmium. Much higher level

is found near Zinc smelter, as cadmium usually occurs with Zinc.

Discharge of Cadmium into water is mainly from the electroplating industry which accounts for around 50%. Another source is nickel-cadmium battery industry. Fertilizers which contain up to 8ppm of Cadmium are also a source of pollution. Fungicides contain cadmium. The outbreak of cadmium poisoning occurred in Japan in the form of itai itai or "ouch ouch" disease.Many people suffered from this disease in which their bones became fragile. At high level cadmium causes kidney problems, anaemia and bone marrow disorder. Chronic Cadmium poisoning causes kidney stones and produces proteinuria. Hypertension in humans is also said to be associated with high levels of Cadmium / Zinc ratio in the kidney [5].

Symptomslike rheumatism, neuritis, bone pain etc are due to Cadmium. Acute poisoning leads to vomiting, abdominal cramps and general weakness. Cadmium is considered as highly toxic and non essential element as it forms strong bonds with sulphur leading to displacement of essential metals like [zinc] Zn [2+] and [calcium] Ca [2+] from binding sites of certain enzymes.It[s] toxicity affects the ecosystem and is a risk for human health [6].

More severe cadmium damage may also involve the glomeruli, detected by increased insulin clearance. Other possible effects include aminoaciduria, glucosuria and phosphaturia. Disturbances in renal handling of phosphorus and calcium may cause resorption of minerals from bone, which can result in the development of kidney stones and osteomalacia. Many cases of itai-itai disease (osteomalacia with various grades of osteoporosis accompanied by severe renal tubular disease) and low-molecular-weight proteinuria have been reported among people living in contaminated areas in Japan and exposed to cadmium via food and drinking-water. The daily intake of cadmium in the most heavily contaminated areas amounted to 600–2000 µg/day; in other less heavily contaminated areas, daily intakes of 100–390 µg/day have been found (WHO, 1992). A relationship between chronic occupational exposure to cadmium or chronic oral exposure to cadmium via the diet in contaminated areas and hypertension could not be demonstrated. Epidemiological studies of people chronically exposed to cadmium via the diet as a result of environmental contamination have not shown an increased cancer risk. The results of studies of chromosomal aberrations in the peripheral lymphocytes of patients with itai-itai disease exposed chronically to cadmium via the diet were contradictory. No reliable studies on reproductive, teratogenic or embryotoxic effects in humans are available. Epidemiological studies of humans exposed by inhalation to relatively high cadmium concentrations in the workplace revealed some evidence of an increased lung cancer risk, but a definite conclusion could not be reached [7, 9].Because of all its harmful effect this study was taken in to consideration as fish from Varal Devi lake is consumed by the local inhabitant of Bhiwandi city .If this heavy metal affected fish eaten by people then it leads to several disease in human being.

2. METHODOLOGY

The Oreochromis Niloticus fish collected from the lake pre,during and post Idol immersion activities during morning hours. The fish sample were collected and dissected to separate the organs .Acid extract of this separated organs were prepared and analyzed for heavy metal using analytical technique (UV Visible Spectrophotometry). Size and Weight of the fish will be determined which is different for different species of fish. [1, 2]

Table 1: (Biometry of the Oreochromis Niloticus Tilapia Fish)

Sr. No.	Measurement	BI	DI	PI
01	Color	Light pink	Black	Greyish black
02	Wet weight	323.4gm	375.0gm	300gm
03	Size	246mm	230mm	230mm

BI (Before Immersion)
DI (During Immersion)
PI (Post Immersion)

3. OBSERVATION

The extracted cadmium metal from the fish organs reacts with dithiozone in the basic medium and pinkish orange colour cadmium dithiozonate complex is formed .This complex get extracted in to chloroform and measured spectrophotometrically.

Table 2: (Amount of Cadmium)

Sr.No	Period	Amount ofCadmium in ppm			
		Liver	Kidney	Gills	Abdominal Muscle
01	BI	7.01 ±0.1	0.000 ±0.0	4.6 ±0.0	0.0
02	DI	12.45±0	12.5 ±0.10	21.0 ±0.01	0.0
03	PI	13.5 ±0.0	13.90 ±0.0	22.4 ±0.4	0.0

±SD
BI (Before Immersion)
DI (During Immersion)
PI (Post Immersion)

Table 3: (Amount of Cadmium)

Sr.No	Period	Amountof Cadmium in µg/g of dry fish organs				FAO (1983) µg/g
		Liver	Kidney	Gills	Abdominal Muscle	
01	BI	666.34	0.000	103.60	0.0	
02	DI	696.30	3906.2	411.37	0.0	0.5

03	PI	1001.4	3928.57	694.25	0.0	

BI (Before Immersion)
DI (During Immersion)
PI (Post Immersion)

4. RESULT AND DISCUSSION

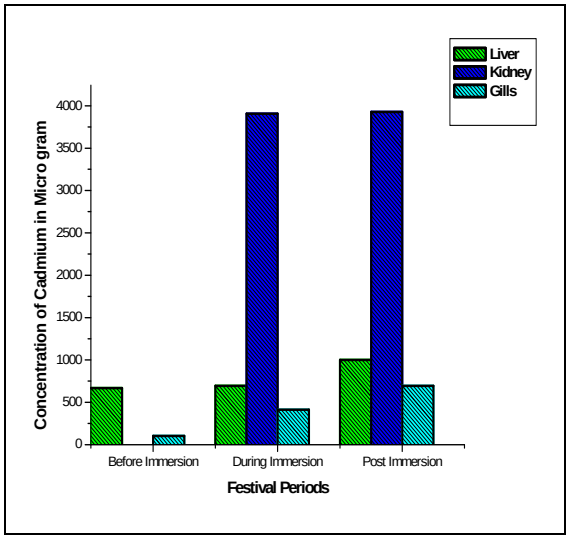

Fig.1: Graph of Concentration of Cadmium against Festival Periods

Amount of Cadmium in three organs of Oreochromis Niloticus fish are greater than the standard prescribed by FAO (0.5 µg/g dry weight of fish organ) [10].Concentration of Cadmium absorbed by kidney is very high than the liver and gills during and post Idol immersion activities. Abdominal muscle show no absorption of cadmium. The concentration of cadmium gets increased due to immersion activity. Concentration of Cadmium in kidney before immersion is Zero but during and after immersion get increased from 3906 µg/g to 3928 µg/g dry weight of fish organ. The order of absorption of Cadmium by fish organs are as follows.

Kidney >Liver > Gills

This indicates that idol immersion activity increases the concentration of heavy metals in the lake water in which the fish grows and this metal enters the fish organs. During immersion activity less amount of heavy metals are released but after immersion more amount of heavy metals are released in to the water which is absorbed by the fish growing in this polluted water.

5. CONCLUSION

From the mythological point of view the water bodies are related to religious sentiments but from the scientific point of view, pollution load on water bodies like lakes has increased significantly during idol immersion period &is not suitable for human use.

Concentration of heavy metal or any pollutant in the organism is the result of past as well as current pollution levels in the environment in which the organism lives.
From the heavy metal concentrations mentioned above we can see thatconcentration of Cadmium in fish organs are crossing the limits as prescribed bythe FAO.It suggests a high risk to the health of human being on the consumption of contaminated fish (WHO, 2001).
Therefore it is recommended that the practice of trace element detection should be continued in order to update whether the heavy metal concentration is above or below the permissible limits and if it is above the limit then precautions must be taken to avoid possible consumption of contaminated fish. It is also recommended that awareness should be spread among the people regarding the hazards on consumption of polluted water and related fish. We will also try to motivate the people avoid using lake which provide drinking water and edible fishes for immersion purpose.

REFERENCE

[1] Kaur.R.,"Effect of idol immersion on marine and fresh water-bodies",*Pelagia Research Library ,Advances in Applied Science Research*, 3, 4,2012,pp.1905-1909.

[2] J, M.D., A. M., R, M., N, S., Bhat .S. A.,S., S.Palanimuthu, D.,"Histopathology Of The Gill, Liver and Kidney Tissues of the Freshwater Fish Tilapia Mossambica exposed to Cadmium Sulphate", *International Journal Of Advanced Biological Research,* 2, 4, 2012, pp. 572-578.

[3] Kaur R. D. O, "Comparison of immersion effects of idols made of different materials on the water quality parameters", *Indian journal of Fundamental and applied life sciences ,* l3, 1, 2013, pp.16-23

[4] Turkmen .M., Turkmen .A., Tepe .Y.,"Metal Contamination in five fish species from Black, Marmara, Aegean and Mediterranean seas, Turkey", *Journal of Chilean Chemical Society*,53, 1, 2008.

[5] Ntiforo .A , Dotse .S.Q. and, Anim-Gyampo .M, "Preliminary Studies on Bioconcentration of Heavy Metals in Nile Tilapia from Tono Irrigation Facility", *Research Journal of Applied Sciences, Engineering and Technology*, 4, 23, 2012, pp.5040-5047.

[6] Pandey G. and M. S., "Heavy Metals Causing Toxicity in Animals and Fishes", *Research Journal of Animal, Veterinary and Fishery Sciences* ,2, 2, 2014,pp.17-23.

[7] Sani .U. ," Determination of some heavy metals concentration in the tissues of tilapia and catfishes",*Nigerian Society for Experimental Biology*, 23, 2, 2011, PP. 73-80.

[8] Singh T. A, Meitei .L. B. and Meetei .N. S," Distribution Pattern of Enteropathogens in Greater Imphal Area of Imphal River, Manipur", *Current World Environment* , 7,2, 2012, pp.259-265.

[9] WHO/SDE/WSH/03.04/80/Rev/1,English only,"Cadmium in Drinking-water,Background document for development of WHO Guidelines for Drinking-water Quality"

[10] Nnaji, J. C., Uzairu, A., Harrison, G. F. S. and Balarabe, M. L," Evaluation Of Cadmium, Chromium, Copper, Lead and Zinc Concentrations in the Fish Head/Viscera of Oreochromis Niloticus and Synodontis Schall of River Galma, Zaria, Nigeria"*Electronic journal of Environmental,agricultural and food chemistry*, 6 ,10, 2007,pp.2420-2426.