

STUDIES ON BIOACCUMULATION OF HEAVY METALS IN *Clarius batrachus* of CUTM POND

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ABSTRACT

The current study was aimed to determine the bioaccumulation heavy metals in fresh water fish *Clarius batrachus* (walking catfish) in CUTM pond. The investigation of bioaccumulation of heavy metals in this species and presence of heavy metals in pond water showed that concentration of heavy metals such as P, S, K, Ca, Cl, Fe, Sn were 659.72 ± 0.178885 , 313.26 ± 0.230217 , 157.52 ± 0.238747 , 270.84 ± 0.230217 , 57.8 ± 0.223607 , 624.24 ± 0.31305 , 42.54 ± 0.270185 respectively. The concentration of heavy metals in *Clarius batrachus* were such as P, S, K, Ca, Cl, Fe, Sn were 971.38 ± 0.192354 , 729.06 ± 0.207364 , 511.4 ± 0.223607 , 268.26 ± 0.207364 , 253.38 ± 0.192354 , 16.34 ± 0.230217 , 49.56 ± 0.207364 respectively. Besides these heavy metals some other heavy metals were present in the both the collected water and the fish *Clarius batrachus* such as Ti, Cu, Sm in a very small extent. The analysis of the tabulated data was performed by using statistical tool to evaluate the mean and standard deviation.

KEYWORDS: Bioaccumulation, *Clarius batrachus*, Heavy metals

INTRODUCTION

The dissolved solids of water mass influence the chemical density, abundance, and composition of the biotic community. In the recent years world consumption of fish has increased with the growing concern of their nutritional and therapeutic benefits. In addition to its importance source of protein, fish typically have rich contents of essentials minerals, vitamins and unsaturated fatty acids (Gado and Midany, 2003). The American heart association recommended eating fish at least twice per week in order to reach the daily intake of omega-3 fatty acids (Eherton *et. al.*, 2002).

However, fish are relatively situated top of the aquatic food chain so; they normally can accumulate heavy metals from food, water and sediments (Burger *et. al.*, 2002). The major heavy metals that are mainly accumulated are chromium, cadmium, lead, mercury, zinc etc. Due to this heavy metals many marine life has been destroyed. Presence of heavy metals in fish gives impact to the human health. Besides, fish is a very suitable bioindicators of heavy metals contamination (Bervoets and Blust. 2003). Early studies have identified the rise in the pollutants of particular heavy metals in the fresh water system around the world particularly in rivers. The accumulation of heavy metals driven by physiochemical and biological variables such as Ph, temperature, hardness, exposure duration of feeding habits of species and habitat complexity.

The *Clarius batrachus* is a fresh water as well as brackish water fish from the actinoptergii class siluriform order and clariidae family. This fish was first described by Linnaeus (1758). It mainly inhabited in lowland streams, swamps, rice paddies, river, flooded areas, canals and stagnant water (Froese and Pauly; 2009). In the aquaculture view this fish cultured in muddy and shallow water (Debnath and Surjit, 2009).). This fish has an elongated body broad at anterior and narrow at the posterior. The occipital process is pointed and doesn't have large number of small white spots (Teugels et.al, 1999). It lacks of adipose fins and fins are without spines. Pectoral fins with fine serration, caudal fins are short and caudal fins are not confluent with dorsal and anal fins. The mouths have four pairs of well developed barbels with the maxillary barbels reaching to the middle or base of the pectoral fins (Talwar and Jhingran; 1991). Its body color varies i.e grayish to olive with a white whitish underside. Other color varieties includes albino with white body and normal colored eyes (Axelrod et.al 1971). *Clarius batrachus* mainly founded in south East Asian counties like Malaysia, Java, Sumatra and Borneo. It also found in water of south Asian countries like Srilanka, India, Bangladesh, Nepal, Laos, Cambodia, and Singapore, Vietnam (Froese and Pauly 2004). It has both nutritional value with the capacity of bioaccumulation of heavy metals (D. Ray et.al 1990) for which this fish is an excellent biomarker of heavy metals and it can determined the different physiochemical criteria like pH temperature hardness etc .of a particular water body

MATERIALS AND METHODS

Collection of water sample

Water sample were collected from CUTM Pond for the analysis of heavy metals.

Collection of Specimen

Fresh water fish *Clarius batrachus* (catfish) were collected from Railway market of Jatani, Khurda district, Odisha

Experimental site

The experiment was carried out in Zoology laboratory of Centurion University of Technology and Management, BBSR

Methodology

Initially measured the pH, conductivity, TSS (Total Suspended Solid) and TDS (Total Dissolve led Solid) of collected water from CUTM pond and the heavy metals present in this water sample was analyzed by using XRF method. The total ph of CUTM pond water was estimated by Ph meter and conductivity was measured by conductivity meter. The TSS and TDS was calculated by filter paper. Then the fishes (*Clarius batrachus*) were exposed in this polluted water. Before exposed in the polluted water the weight and length of the fish should measure. After 15 days of exposure the fishes were dissected using stainless scalpels. Muscles of the fish from each sample were taken for analysis. Dissected samples were transferred to the Teflon beaker was performed in nitric acid digestion to prepare the sample for heavy metal analysis. Sample was then digested with 5ml of nitric acid (65%) and after complete digestion, then placed it oven for 32 hours in 100⁰.C. The samples were cooled to room temperature and dilute to double distilled water. All the digested samples were analyzed for heavy metals by using XRF spectrophotometer.

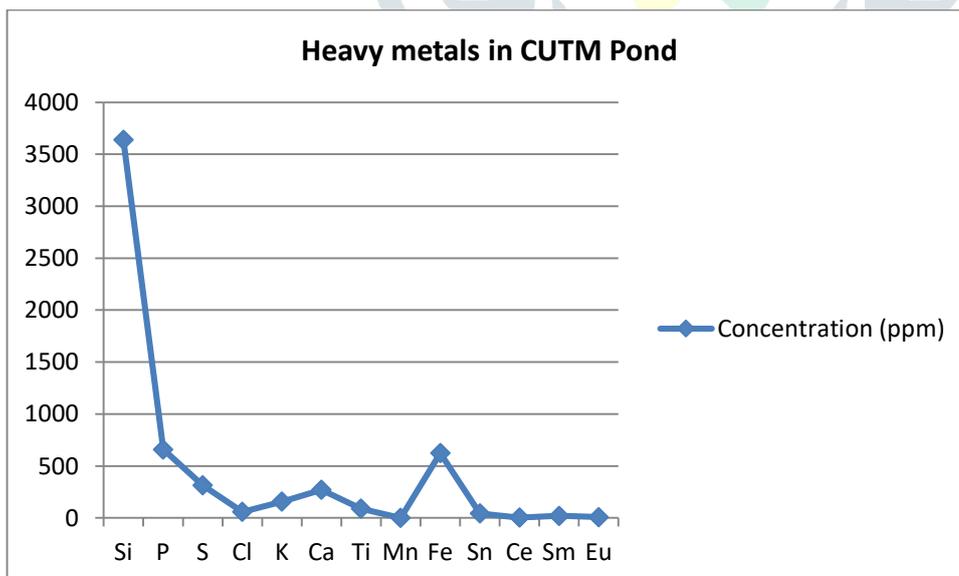
RESULTS AND DISCUSSION

The total Ph of collected water is 7.27 and conductivity is 0.334×10^{-3} Siemens/meter.

The study resulted bioaccumulation of heavy metals in this species and presence of heavy metals in pond water showed that concentration of heavy metals such as P, S, K, Ca, Cl, Fe, Sn were 659.72 ± 0.178885 , 313.26 ± 0.230217 , 157.52 ± 0.238747 , 270.84 ± 0.230217 , 57.8 ± 0.223607 , 624.24 ± 0.31305 , 42.54 ± 0.270185 respectively. The concentration of heavy metals in *Clarius bacrachus* were such as P, S, K, Ca, Cl, Fe, Sn were 971.38 ± 0.192354 , 729.06 ± 0.207364 , 511.4 ± 0.223607 , 268.26 ± 0.207364 , 253.38 ± 0.192354 , 16.34 ± 0.230217 , 49.56 ± 0.207364 respectively. Besides these heavy metals some other heavy metals were present in the both the collected water and the fish *Clarius bacrachus* such as Ti, Cu, Sm in a very small extent.

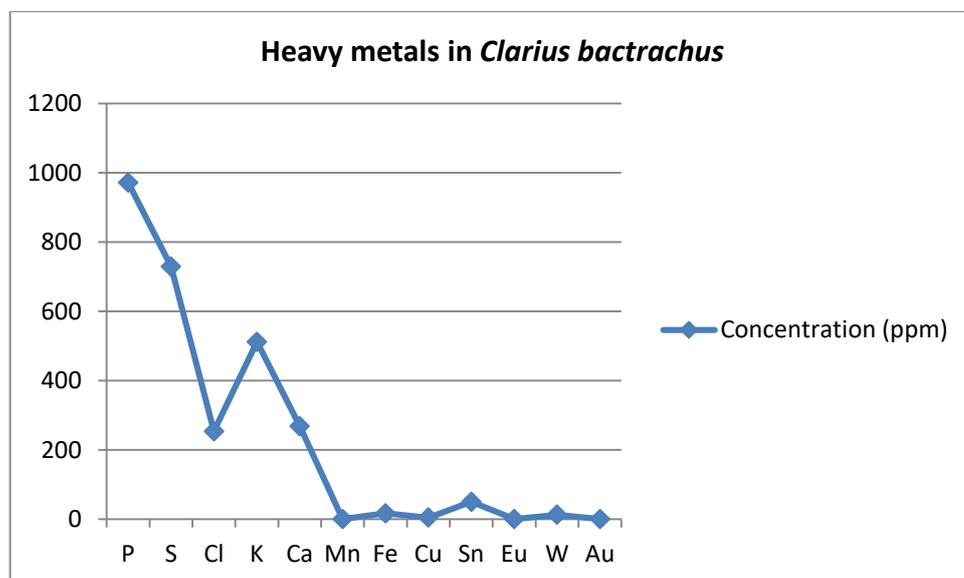
Serial No.	Compound Name	Concentration (ppm)
1	Si	3640
2	P	659.7
3	S	313.2
4	Cl	57.9
5	K	157.4
6	Ca	271.2
7	Ti	89.4
8	Mn	0.0
9	Fe	624.1
10	Sn	42.7
11	Ce	3.1
12	Sm	20.1
13	Eu	7.3

Table-1 Concentration of heavy metals in CUTM pond water



(Figure 1. Graphical representation of concentration of heavy metals in CUTM Pond)

Serial No.	Compound Name	Concentration (ppm)
1	P	971.3
2	S	729.1
3	Cl	253.6
4	K	511.5
5	Ca	268.5
6	Mn	0.0
7	Fe	16.7
8	Cu	4.0
9	Sn	49.6
10	Eu	0.0
11	W	12.7
12	Au	0.0

(Table-2. Concentration of bioaccumulation of heavy metals in *Clarius bacrachus*)(Figure 2. Graphical representation of bioaccumulation of heavy metals by *Clarius bacrachus*)

Name of Heavy metal	Heavy metals concentration in water of CUTM Pond	Heavy metals concentration in <i>Clarius bacrachus</i>
Si	3638.8±1.30384	0.0
P	659.72±0.178885	971.38±0.192354
S	313.26±0.230217	729.06±0.207364
Cl	57.8±0.223607	253.38±0.192354
K	157.52±0.238747	511.4±0.223607
Ca	270.84±0.230217	268.26±0.207364
Ti	89.52±0.238747	0.0
Mn	0.0	0.0
Fe	624.24±0.31305	16.34±0.230217
Sn	42.54±0.2701	49.56±0.207364
Ce	3.2±0.223607	0.0
Sm	20.16±0.194936	0.0
Eu	7.24±0.240832	0.0
Cu	0.0	4±0.223607
W	0.0	12.34±0.230217

(Table 3. analysis of heavy metals in CUTM pond water and *Clarius bacrachus*)

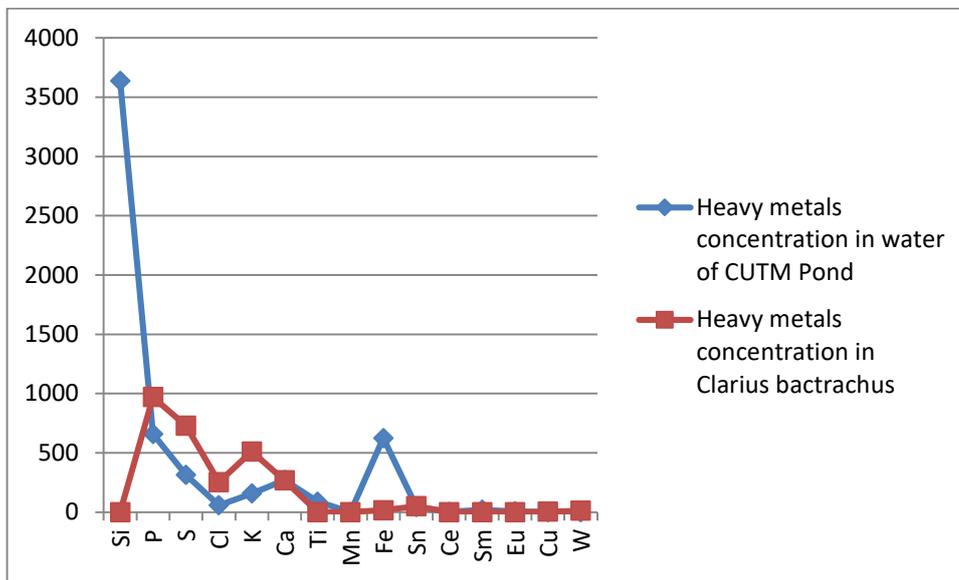


Figure 3. Comparison of heavy metals in CUTM pond water and *Clarius bacrachus*

From the data it can observe the heavy metal concentration of pond water comparatively less than the heavy metal bioaccumulated by *Clarius bacrachus*. It due to the fresh water fish has high accumulation power than the marine fish (Mensor and Said, 2018).

CONCLUSION

Heavy metals are one of the most important pollutants in the natural environment because of their toxicity. By uptake of metals from polluted water the physiological system and metabolism of human got changed. Besides these foods, sediment as well other environmental factors like temperature, salinity, dissolved oxygen and interacting agents also affected the uptake metals into the human body.

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