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BIOACCUMULATION OF HEAVY METALS IN WATER AND FISHTISSUES (clariasgariepinus) OF BALUGAON, CHILIKA, ODISHA

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ABSTRACT

The present study focused on the determination of physicochemical parameter and heavy metal accumulation in water and in fish species (clarius gariepinus) from Balugaon, Chilika, Odisha. The analysis of physicochemical properties of water carried out by some parameters such as water temperature, pH, conductivity, total dissolved solid, hardness, dissolved oxygen. Chilika lake is the largest brackish lagoon. Chilika lake have the highest ecological value in Odisha. It is polluted due to the industrial waste and anthropogenic activities. The heavy metal detection occurred by using XRF- Spectro photography. The heavy metals in water found to be Mn<Sn<Fe<S<P<Cl. The accumulation of heavy metals in liver found in following manner Mn<Sn<Cu<Fe<S<P<Ca<Cl, in gill Mn<Ti<Zn<Fe<S<P<Cl, in in flesh Mn<Cu<Ti<Zn<Fe<Cl. Flesh contains lowest amount of metals as compared liver and gill. This study is useful for the metal pollution and decrease the water pollution and increase the public awareness.

KEY WORDS

Pollution, Heavy metal accumulation, physicochemical parameters.

INTRODUCTION

The pollution of the aquatic ecosystem due to the heavy metal is a world-wide problem now a days [Diagomanolin et al.2004]. These pollutions are increased due to the advancement in human lifestyle due to science and technology causes environmental contamination [Muhammad Iftikhar khan et al.2018]. heavy metals are the pollutants that arises both natural and anthropogenic activities. The natural sources are whearthering of metal containing rock and volcanic eruption and anthropogenic sources are agricultural activities,mining,smelting activities. Increasing the urbanization,industrialization causes excess pollution of water now a days. Heavy metals are the elements having high densities above 3.5g/cm3 to 7g/cm3. These metals are non-biodegradable these are

transported from one tropic level to anthore tropic level. Heavy metals having more specific gravity that is 4 to 5 times higher the specific gravity of water at same temperature and pressure [DuruibeJO et al.1995]. The concentration above the limited value affect the water properties like pH,salinity,conductivity etc[H.Spigegel 2002]. Heavy metal assiduity in aquatic ecosystem is determined by monitoring their concentration in water,sediments and biota.

Heavy metals are toxic to all the organisms,these are accumulate in soil,water and all the living organisms present in food chain. These heavy metals are causes serious problems due to their toxic nature,long persistence and biomagnification in the foodchain.Heavy metals like arsenic(As),cadmium(Cl),chromium(Cr),chlorine(Cl), zinc(Zn) etc are more toxic to human body and also dengerious to the other organisms.Heavy metals are associated with so many health risk like- cancer,cardiovascular disease,respiratory disease,also causes skin disease in human.These elements are accumulated in fish through the food chain . these metals are neurotoxin for the fish.

Fish are the most important food sources of human and useful bioindicators for the determination of metal pollution [CHOVANEC A et al,2003] [LAMAS S et al,2007]. Now a days the population is increased, so the requirement of proteins is also increased. the fish are the most important protein sources [ELETTA O.A.A 2003]. The consumption of the fish is increased due to its nutritional and therapeutic values. It provides omega -3 fatty acid, fat and vitamins to the human body. So the study of heavy metals in fish tissues and water is a useful and essential for the society.

Here I was collected fish species clarias gariepinus, which is otherwise called African catfish.from the balugaon,chilika. The cat fish is important for the economy and therapeutic values. It provides omega – 3 and 6 fatty acid, and it provide low caloeies. Chilika lake is the largest brakish water lagoon in the subcontinental along the east cost of India, situated between 19º28’ - 86º50’N and 85º06’ - 85º35’E. It is spread over the puri,khorda and Ganjam district of Odisha ,at the mouth of the Daya river ,flowing into the Bay of Bangel. It is the largest wetland along the east cost of India. The average water spread over the lagoon is 1055sq.km. the lagoon is a highly productive ecosystem. The chilika aquatic ecosystem is polluted due to some natural process like alternation of the physical chemical parameters of water due to the climatic changes and some anthropogenic effect like aquaculture and other anthropogenic activities.

The study of heavy metal accumulation was useful for understanding the water parameters and water quality of the Balugaon, chilika water. It also useful monitoring the amount of different metals in different tissues of the fish.

MATWEIALS AND METHODOLOGY

The water and fish sample were collected from Balugaon,Chilika,Odisha. Chilika is the queen of natural beauty, it is the Asia’s biggest island saltwater lagoon. Chilika lagoon is a highly productive ecosystem and biodiversity rich area.

After the collection of samples, the water sample were collected in a bottle. The bottle was sterilized by using nitric acid. The bottle was washed with water at the sample collection site. Then the bottle was put inside the

water, about 20 to 25 cm below the water surface. The water sample was collected and take on the laboratory, then added 5ml of nitric acid inside the bottle. The fish was collected using nets by the help of the local fisherman and then taken in a ice box and take inside the laboratory then washed the fish by using water for the removal of the dust and mud then taxonomical identification occurred. According to the taxonomist the collected fish was Clarias gariepinus. After the washing the fish different organs like liver, gill, flesh was dissected by using sterile laboratory scissors. Then different tissues of the species taken different petrisidh and then put inside the oven at 120 degree Celsius for 3 days. After 3 days the tissues were dried then the dried form of tissues are grinded by using laboratory ceramic motor and pestel then powder form were arises. Then weighted 0.5gm of each sample and digested the tissues by using acid (nitric acid and perchloric acid in 3:1 ratio) and then added 25 ml of distelled water for the dilution [Tabassum et al,2016]. Analysed the heavy metals by using XRF-spectrophotometer, the amount of heavy metals in water also determined by using XRF-spectrophotometer.

The water parameter like pH, conductivity was measured by pH meter and conductivity meter, temperature of the water was determined by using mercury thermometer. The TDS, hardness, DO was also measured by laboratory tritration methods.

RESULT AND DISUSSION

Table 1. Physicochemical parameters of water sample.

parameters	Test result
pH	8.5
Temperature	28 degree Celsius
Conductivity	4000micro mho/cm
TDS	975mg/l
Hardness	792ppm
DO	5.5mg/l

Table 2. Heavy metal accumulation in water and fish tissues.

Heavy metals	Water (in ppm)	Gill (in ppm)	Flesh (in ppm)	Liver (in ppm)
Si	822.8	531	839	202
P	602.2	253	136	638
S	182.2	848		
Cl	2600	5370	4981	58581
k	284.9	1048		
Ca	239.3	13990	28424	11943
Mn		104.4		
Fe	69.1	1460	472	2354
Sn	43.6			1161
Eu	8.1		152	
Ti		147.3	788.6	
Cu			190.1	980
Zn				
Br		152.8	193	
Zr		2.0		

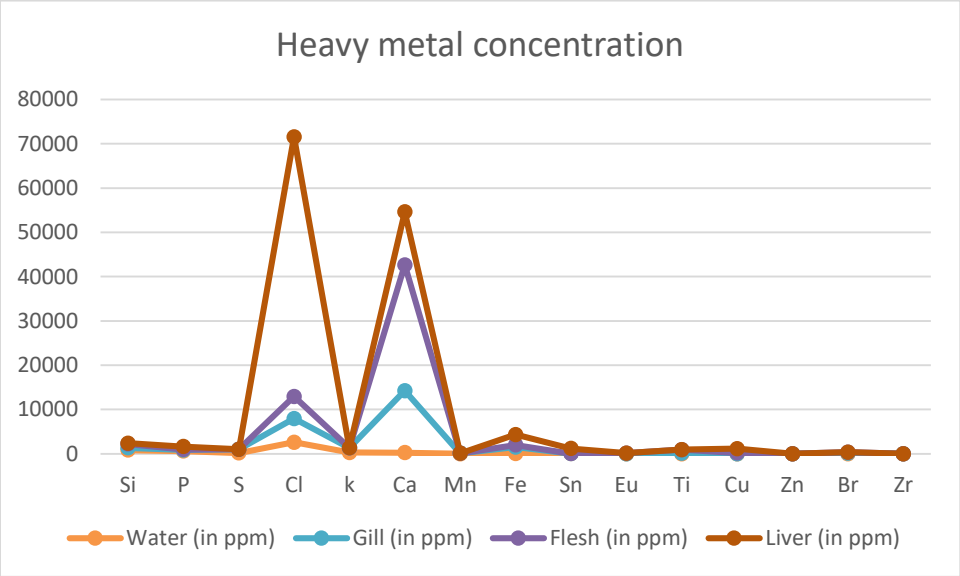

Figure 1. Showing heavy metal concentration in water and fish tissues discharge.

The heavy metals are mainly arising from the industrial wastes. The presence of heavy metals in ecosystem causes various harmful effects to all the organisms. The amount or concentration of these heavy metals increased due mainly anthropogenic activities now a days. Water is the important natural sources. The industrial and other

wastes are discharged into water, which causes the water pollution and eutrophication. The water pollution affects the environment directly and indirectly due to the water pollution the water losses its properties like pH, DO, conductivity etc, which affects the aquatic diversity. During the study the physicochemical parameters of Chilika water was alkaline having pH 8.5, conductivity was 4000micro mho/cm and DO was 5.5mg/l, the hardness of water was

Fish is the important food sources and it is the most important biological indicator. The advantages of this study to decrease the pollution rate in water and increase the public awareness to prevent

Accumulation of metals in fish causes harmful effect to the ecosystem. In this study fish was collected from Balugaon, chilika water. The heavy metals like Ti, Fe, Sn, accumulated in few concentrations in water. Cl was more concentration in chilika water and other elements like P, S, Ca, K was found in chilika water. The fish accumulated some heavy metals from its habitat. Heavy metals like Ti, Zn, Mn, Fe accumulated in fish body, and other elements was also found in fish body (K, S, P, Cl). Highest amount of chlorine was found in fish tissues and also water. The fish gill tissues accumulate more Fe and less Mn (Mn<Ti<Fe<S<P<Cl). Liver accumulated more Fe among all and also flesh contain more Fe among all. Concentration of the Chlorine (Cl) was more in fish tissues and water among all metal. So the water is useful for the aquatic organism but do not useful for the domestic uses.

CONCLUSION

The main purpose of this study is to decrease the pollution of water in chilika water and increasing the public awareness and decreasing the discharge of wastes in water. The limnological parameters was altered due to the increasing the pollution rate. Mn, Fe, Zn, Cu, Cl were found in water and also found in fish tissues. Among all heavy metal Cl was more. The amount of heavy metals was different in different organs of fish. The water contains normal level of metals which is useful for agriculture, aquaculture. The heavy metals present in the water and fish was not above the reference values. Determinations of heavy metals in chilika water was essential because this lagoon have highly productive ecosystem with more fishery resources. The fish was accumulated the metals and causes severe human health diseases.

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REFERENCES

- Bawuro, A. A., Voegborlo, R. B. and Adimad, A. A. (2018). "Bioaccumulation of Heavy Metals in Some Tissues of Fish in Lake Geriyo, Adamawa State, geriao1". Hindawi Journal of Environmental and Public Health Volume, Article ID 1854892, 7 pages.
- Adebayo, I. A. (2017). "Determination of Heavy Metals in Water, Fish and Sediment from Ureje Water Reservoir". J Environ Anal Toxicol, 7:4 DOI: 10.4172/2161-0525.1000486.
- Adebayo, O. O., Daramola, O. A. (2013). Economic analysis of catfish (Clariasgariepinus) production in Ibadan metropolis.Journal of Agriculture and Food Sciences.[Internet]. 1(7): 128-134.
- Alibabič, V., Vahčič, N., Bajramovič, M. (2007). Bioaccumulation of metals in fish of Salmonidae family and the impact on fish meat quality. Environ. Monit. Assess. 131, (1-3), 349, 17.
- Avenant-Oldewage and Marx, H. M. (2000). "Bioaccumulation of chromium, copper and iron in the organs and tissues of Clariasgariepinus in the Olifants River, Kruger National Park," Water SA, vol. 26, no. 4, pp. 569–582.
- Chovanec, A., Hofer, R., Schiemer F. (2003). Fish as Coast of Spain. Environ. Int., 1069, 1.
- Diagomanolin, V., Farhang, M., Jafarzadeh, N. (2004). Heavy Metals in the Karoon Waterway River, Iran. ToxicolLett 15: 63-68.
- Duruibe, J. O., Ogwuegbu, M. O. C., Egwurugwu, J. N. (2007). Heavy metal pollution and human biotoxic effects. Int J PhysSci 2(5):112–118.
- Eletta, O. A. A., Adekola, F. A., Omotosho, J. S. (2003). Determination of concentration of heavy metals in two common fish species from Asa River, İlorin, Nigeria. Toxicol. and Environ. Chem. 85, (1-3), 7.
- Spiegel, H. (2002). "Trace element accumulation in selected bioindicators exposed to emissions along the industrial facilities of Danube Lowland," Turkish Journal of Chemistry, vol. 26, no. 6, pp. 815–823.
- Lamas, S., Fernandez, J. A., Aboal J. R., Carballeris, A. (2007). Testing the use of juvenile Salmo trutta L., as biomonitors of heavy metal pollution in freshwater. Chemosphere, 67, 211.
- Öztürk, M., Özözen, G., Minareci, O., Minareci, E. "Determination of Heavy Metals in Fish, Water and Sediments of Avsar dam lake in Turkey". Iran. J. Environ. Health. Sci. Eng., 2009, Vol. 6, No. 2, pp. 73-80.
- Khan, M. I., Khisroon, M., Khan, A., Gulfam, N., Siraj, M., Zaidi, F., Ahmadul, Abidullah, Fatima, S. H., Noreen, S., Hamidullah, Shah, Z. A. and Qadir, F. (2018). "Bioaccumulation of Heavy Metals in Water, Sediments, and Tissues and Their Histopathological Effects on Anodontacygnea (Linea, 1876) in Kabul River, Khyber Pakhtunkhwa, Pakistan". HindawiBioMed Research International, Article ID 1910274, 10 pages.
- Başyiğit, B., Tekin-Özan, S. (2013). "Concentrations of Some Heavy Metals in Water, Sediment, and Tissues of Pikeperch (Sander lucioperca) from Karataş Lake Related to Physico-Chemical Parameters, Fish Size, and Seasons".Pol. J. Environ. Stud. Vol. 22, No. 3.

- Lawson, E. O. (2011). "Physico-Chemical Parameters and Heavy Metal Contents of Water from the Mangrove Swamps of Lagos Lagoon, Lagos, Nigeria".Advances in Biological Research 5 (1): 08-21, ISSN 1992-0067.
- Kargin, F. (1998). "Metal Concentrations in Tissues of the Freshwater Fish Capoetabarroisi from the Seyhan River (Turkey)," Bulletin of Environmental Contamination and Toxicology, vol. 60, no. 5, pp. 822–828.
- Ambedkar, G. and Muniyan, M. (2012). analysis of heavy metals in water, sediments and selected freshwater fish collected from gadilam river, Tamilnadu, India". International Journal of Toxicology and Applied Pharmacology.
- Ismail, I., Saleh, I. M. (2012). "Analysis of heavy metals in water and fish (tilapia sp.) samples from tasik mutiara, puchong" The Malaysian Journal of Analytical Sciences, Vol 16 No 3: 346 – 352.
- Izuchukwu, U. I., Okeke, D. O. and Okpashi, V. E. (2017). "Determination of Heavy Metals in Fish Tissues, Water and Sediment from the Onitsha Segment of the River Niger Anambra State Nigeria", J Environ Anal Toxicol, 7:5.
- Tabassum, B., Bajaj, P., Sarah, R. (2016). Accumulation of arsenic induced by E-waste in fresh water fish, Channa Punctatus. BAOJ Biotechnology;2(3):019.