



ANALYSIS OF PHYSICO-CHEMICAL PARAMETERS AND HEAVY METALS COMPOSITION OF WATER AND FISH SPECIES (*Ompok bimaculatus*) OF JOBRA ANICUT, MAHANADI, CUTTACK

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ABSTRACT

Water is essential for life. The present study is based on the assessment of physico-chemical parameters and heavy metals composition in water and fish from Jobra, Anicut, Mahanadi, **Cuttack**. People used water for many purposes and consume fish from the Mahanadi River due its nutritional value. The accumulation of heavy metals in fish tissues causes detrimental effects on fish. The study revealed that the water is polluted due to anthropogenic activities. The heavy metals found in water were Ti, Sn, Fe, Ca, Er, Ca, K, Cl, P, Si. Fleshes of fish accumulate more Fe and Zn than other tissue. Gills accumulate more Mn than other tissue.

Keywords: Physico-chemical parameters, heavy metals, pollution

INTRODUCTION

Water is essential to life because all life forms are dependent on it (Abowei and George, 2009). Water is the medium of life. Water has the capability for transmitting diseases when water is contaminated by pollutants (Yakasai, 2004). The aquatic system has been contaminated with heavy metals released from domestic, agricultural and industrial activities (Velez and Montaro, 1998). Heavy metals are generally found at very low concentration in nature, but the concentration of heavy metals rose due to the anthropogenic activities (Forstner and Wittmann, 1981; Idodo-Umeh, 2002). Fish are extremely vulnerable and exposed to pollution, because they cannot escape from the harmful effects of pollutants, as they are living in the aquatic system (Yarsan *et al.*, 2013; Mahboob *et al.*, 2014; Saleh *et al.*, 2014). The consumption of fish has been increased due to its nutritional and therapeutic benefits, fish is the important source of protein, vitamins and unsaturated fatty acids (Moselhy, 2005). The accumulation of heavy metals in fish is depending on metal concentration, period of exposure, way of metal uptake and environmental factors such as water temperature, pH, alkalinity, hardness, dissolved oxygen (Babatunde *et al.*, 2012). Accumulation of heavy metals in fish occurs through the absorption and human can be exposed to heavy metals through the consumption of affected fish, because fish are located at the end of aquatic food chain. This causes health problem to human (Nord *et al.*, 2004). The objectives of the studies are to determine the physicochemical properties and heavy metals concentration in water and to quantify the metals accumulation in fish and its harmful effects on fish.

MATERIALS AND METHODS

The water and fish specimen sample were collected from Mahanadi, Jobra Anicut, Cuttack. The water samples were collected in bottles. The bottles were first cleaned with nitric acid. The bottles were rinsed with the water from the sampling site. The bottle was dipped to about 20 cm below the water. The sample was taken to the laboratory. 5 ml of nitric acid added to the collected water. The fish specimens were put into an ice box and taken into the laboratory. Fishes were washed with water to remove the mud from the water body. The fish sample identified taxonomically. The fish samples were dissected with sterile scissors to remove gills, muscles and gills. The fish samples were dried separately in oven at 120° C for 3 days. The dried forms of tissues were ground to fine powder by using laboratory

ceramic mortar and pestel. Weighed 0.5gm of each tissue sample and digested with a mixture of nitric acid and perchloric acid in 3:1 ratio. Then digested was diluted with distilled water volume up to 25 ml (Tabassum *et al.*, 2016).

The pH and conductivity of water were measured with pH meter and conductivity meter. The temperature of water measured with mercury thermometer. The total alkalinity, hardness and dissolved oxygen were determined by titration method and the presence of heavy metals in fish and water sample were analyzed in XRF Spectrophotometer.

RESULT AND DISCUSSION

Parameters	Test results
pH	7.3
Temperature	26°C
Conductivity	100 μ mhos cm ⁻¹
Total dissolved solids	490mg/l
Alkalinity	300 mg/l
Hardness	243mg/l
Dissolved oxygen	1.7mg/l

Table 1: Physico-chemical parameters of water sample.

Heavy metals	Concentration in ppm			
	Water	Gills	Muscle	Liver
Si	701.8	16740	2790	358.8
P	592.5	26240	17630	573.5
S	-	23500	12790	-
Cl	409.5	11280	3620	437.6
K	213.4	29540	12640	210.4
Ca	206.3	15400	16690	198.9
Cu	-	-	-	21.2
Mo	-	-	-	11.2
Sn	-	-	-	58.2
Ti	7.6	1160	40.1	-
V	-	5.8	-	-
Er	64	183.6	114.9	6.28
Mn	-	621	32.2	-
Fe	59.8	0.589	2777.5	40.3
Ca	-	74.8	-	-
Zn	-	0.118	115.8	-
Br	-	30.9	5.6	-
Sr	51.8	488.9	-	-
Zr	-	7.0	-	-
Eu	-	461.1	-	-
Pt	-	-	2.2	-
Yb	-	-	-	12.5
W	-	-	-	146.8
Os	-	-	-	0.3

Table 2: Comparative heavy metals concentration accumulated in water and fish tissues.

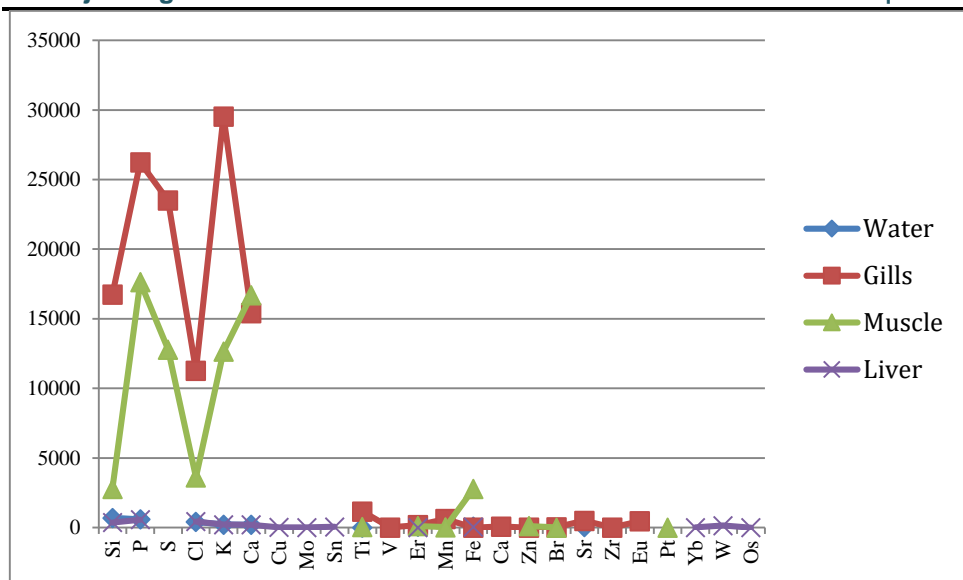


Figure-1 Showing heavy metals concentration accumulated in water and fish tissues.

The physicochemical properties of water are disturbing due industrial and anthropogenic activities. The degree of heat is measured in the form of temperature (APHA, 1985) During the study the temperature of water was found to be 26°C. The pH of water found to be 7.3. The electrical conductivity is the measure of water capability to pass electrical current. The conductivity of water found to be 100 μ mhos cm⁻¹. The total dissolved solid is the presence of organic and inorganic materials in water. In this study the TDS is found to be 490 mg/l. Alkalinity is the test to measure the level of bicarbonate and carbonate ion in water. The alkalinity is the buffering capacity of water. The alkalinity of water sample found to be 300 mg/l. The hardness of water is the amount of dissolved calcium and magnesium in the water. In the study the hardness of water found to be 243mg/l. Dissolved oxygen is the amount of gaseous oxygen dissolved in water. 1.7mg/l of dissolved oxygen found in water sample. The heavy metals P, Fe, Sn, Er, Cl, Ti, Si, K were found in water in the following order Si > P > Cl > K > Ca > Er > Fe > Sn > Ti. The quality of water is good and favorable for aquatic organisms and other purposes. The fish *Ompok bimaculatus* accumulate fewer amounts of heavy metals from the sediment. In fish the heavy metals accumulate in the following order P > Cl > Si > K > Ca > W > Sn > Fe > Cu > Yb > Mo > Er > Os. In liver, P > Ca > S > K > Cl > Si > Fe > Zn > Er > Ti > Mn > Br > Pt in muscles, K > P > S > Si > Ca > Cl > Ti > Mn > Sr > Eu > Er > Ca > Br > Zr > V > Zn in gills. Muscles accumulate more Fe and Zn than other tissue.

CONCLUSION

The physico-chemical parameters of water are altering due to anthropogenic activities. The present study indicated that the water quality is good and concentration of heavy metals in water is not more than that of permissible limit. It is suitable for agricultural use and other purposes. Accumulation of heavy metals is differing in different tissues of fish. Determination of heavy metals in river water is highly necessary because the water used for many purposes and it is also important because the metals present in water accumulate in the fish body which is consumed by human being. Consumption of affected fish causes many health problems.

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