International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(5): 3064-3065

Received: 16-07-2019
Accepted: 18-08-2019

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Zinc (Zn) bioaccumulation in tissues of rohu fish (*Labeo rohita*) cultured in the sewage-fed pond of Kolkata, India: A short note

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Abstract
Sewage fed aquaculture is a common practice in India. But the polluted sewage water can cause heavy metal toxicity in fish as well as humans. So, a study was carried out to assess the level of Zinc (Zn) accumulation in different tissues of rohu fish collected from a sewage fed pond of Kolkata, India. Samples were collected fortnightly from January 2014 to June 2014. Zinc concentrations were found to be 0.66 µg/g, 0.66 µg/g, 0.72 µg/g and 0.22 µg/g in kidney, liver, gill and muscle of fish respectively. Though this was below the safe level, it warns us about the threats of heavy metal toxicity in the future.

Keywords: Bioaccumulation, fish, zinc, rohu, sewage-fed pond

1. Introduction
Sewage-fed aquaculture has been practiced in India for the last 70 years. It is one of the most widely recommended biological wastewater treatment methods. In India, 35 metropolitan cities produce 15,644 Million Liters per Day (MLD) of sewage. But, the sewage treatment capacity of our country is only 51% i.e., 8,040 MLD of sewage. In Kolkata itself, 705.86 MLD of sewage is produced but only 24% is treated [1]. All these untreated sewage is released to the environment. They eventually go to several water bodies including rivers and ponds. So, these are contaminated with several toxic elements including heavy metals. When fishes are cultured in these ponds, there is always a risk of heavy metal toxicity in them. If these contaminated fishes are consumed by human being there will always be a chance of heavy metal toxicity. So, we recognized the necessity of determining the level of toxic metals in the fish. For this purpose a study was carried out to assess the level of Zinc, a potent toxic metal; in rohu fish (*Labeo rohita)* collected from sewage fed pond of Kolkata.

2. Materials and methods
2.1 Location of the study area
The sewage-fed aquaculture pond belonged to 'The Bonhooghly Fishermen's Cooperative Society Ltd., located at 22.64^0N and 88.38^0E in a densely populated area of Kolkata. The lakes of the 'Bonhooghly' and 'Noapara' receive a large quantity of sewage water from the Baranagar Municipality area.

2.2 Selection of species
Labeo rohita popularly called Rohu was selected for the study. It is one of the most popular and regularly consumed fish of west Bengal.

2.3 Collection of samples
The study was conducted from January 2014 to June 2014. Samples were collected fortnightly. The sampling days were denoted as D_1 to D_{12}. The liver (L), kidney (K), gills (G) and muscle (M) of the collected fish were dissected out. They were weighed, dried in a hot air oven and stored in room temperature for further analysis.

2.4 Digestion of the Samples
We followed a modified wet-digestion method of Churnoff (1975) to prepare the fish tissue samples to determine the concentration of Zn [2]. The procedure has been described in the previous article of the author [3].

2.5 Detection of metals by atomic absorption spectrophotometer

The metal content of the samples was detected in Atomic Absorption Spectrophotometer (Varian AA 240) using hollow cathode lamps of Zn. Three standard solutions (0.5 mg/l, 1.0 mg/l and 1.5 mg/l) of Zn were prepared from stock solutions (1,000 mg/l) procured from analytical grade Merck India Pvt. Ltd. The final concentration of each sample was expressed in µg of metal/g (d wt).

2.6 Statistical Analysis

The data generated from the study were tested for significance of variance by single-factor ANOVA (Analysis of Variance) with replication as per the structure of the data. The graphical presentation of the data was also made. All the statistical analysis and graphical presentation were done with the help of Microsoft Excel 2007.

3. Results and discussion

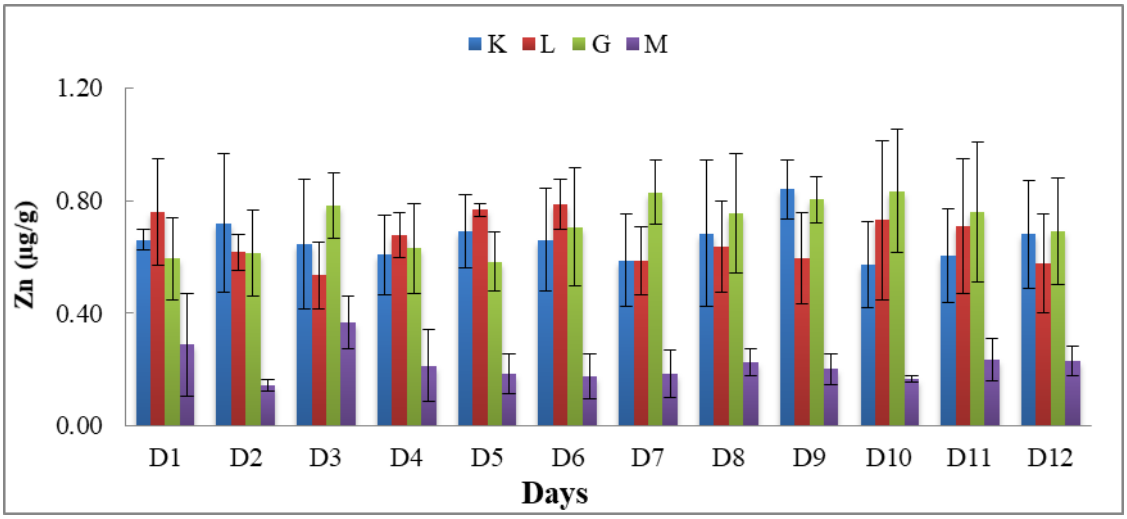

Fig 1: Zinc accumulation (mean ± SD, n=3) in the tissues of Rohu (*Labeo rohita*) cultured in a sewage-fed aquaculture pond

Average Zinc concentrations were found to be 0.72 µg/g in fish gill samples of rohu (Fig 1). The concentration of Zn was found to be 0.66 µg/g in the liver and 0.66 µg/g, in kidney. The average concentration in muscle was found at 0.22 µg/g. Among the four tissues, the highest percentage of Zn was observed in the gill and the lowest percentage observed in the muscle, but it may also reach a high percentage in the kidney and liver of rohu. In kidney, the maximum bioaccumulation observed during May (0.71 µg/g) followed by January (0.69 µg/g), March (0.64 µg/g), April (0.64 µg/g), June (0.64 µg/g) and February (0.63 µg/g). In muscle, the maximum bio-accumulation observed during February (0.29 µg/g) followed by June (0.23µg/g), January (0.22 µg/g), April (0.20 µg/g), March and May (0.18 µg/g). In liver, the maximum bio-accumulation observed during March (0.78 µg/g) followed by January (0.69 µg/g), May (0.66 µg/g), June (0.64 µg/g), April (0.61 µg/g) and February (0.61 µg/g). In gill, the average accumulation of Zn recorded about 0.60 µg/g-0.82 µg/g during the study period.

The maximum bioaccumulation of Zn observed in the gill in rohu (0.72±0.092 µg/g), which is lower than the permissible limit [4]. Kumar and Mukherjee (2011) reported that the concentration of Zn in fish samples from Kolkata wetland was ranged between 22.88 to 92.7 0 µg/g with an average of 48.55±3.46 µg/g which was much higher than the present observation [5]. Puttaiah and Kiran, (2008) also reported the higher concentration of Zn (37.68±11.91 µg/g) in fish reared in the sewage-fed lake of Karnataka, India [6].

4. Conclusion

Though the concentration of Zn in different fish tissues was lower than the permissible limit, the present concentration is also a matter of high concern. It warns us about the possible threat of heavy metals in the near future. It was also observed that the metal was mainly accumulated in offals of the fish compared to the muscle. So, discarding the liver, kidney, gill and other internal organs can be a good step in reducing the metal exposure [7]. Finally, we should try to reduce environmental pollution and treat the effluent water before using it into aquaculture. It will help us to be healthy and offer the next generation a better life.

5. References

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