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CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 16, Issue, 11, pp.594-597, November 2025

International Journal of Recent Scientific Research

ISSN: 0976-3031

STUDIES ON EFFECTS OF HEAVY METALS IN *Channa gachua* (HAMILTON, 1822) FROM TUNIA RIVER, BONGAIGAON DISTRICT, ASSAM, INDIA

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DOI: http://dx.doi.org/10.24327/ijrsr.20251611.0109

ARTICLE INFO

Article History:

Received 20th October 2025
Received in revised form 30th October 2025
Accepted 18th November 2025
Published online 28th November 2025

Key words:

Heavy metals, Biotoxicity, Bioaccumulation.

ABSTRACT

The heavy metals like Ph, Hg, Cd, Cr, Cu, Zn, Mn, Ni, Ag, etc. of which As, Cd, Pb and Hg are considered biotoxin chemicals to humans, animals, fishes and environment Excessive concentrations of these heavy metals has been a matter of serious concern as they destabilize ecosystems because of their bioaccumulation in organisms, and toxic effects on biota and causing death in most living beings including wildlife. These heavy metals can enter into aquatic sources via drainage, atmosphere, soil erosion and all anthropogenic activities and get to the biogeochemical cycle which leads to biotoxicity due to bioaccumulation. The primary reasons of "Heavy metals toxicity is contamination of drinking-water (Pb pipes), high ambient air concentrations near emission sources, or from food chain or biogeochemical cycles Water and Fish samples were collected during the period March-April,2021 from the Tunia River which is a tributary of the Champamati River in the Bongaigaon district of Assam. The paper assessed the bioaccumulation of certain heavy metals in tissues of some freshwater fishes like *Channa, Anabas, Puntius, Colisa* and water sample of Tunia

INTRODUCTION

Aquatic ecosystems worldwide face increasing threats from pollution caused by human developmental activities. Water pollution, in particular, has become a critical issue due to its direct impact on biodiversity, public health, and ecological balance (Gupta *et al*., 2014). Rapid industrialization is one of the major contributors to environmental pollution, especially in areas lacking proper waste treatment facilities. Industries such as textiles, paper mills, petroleum refineries, metal processing, and chemical manufacturing often discharge untreated effluents into nearby rivers and wetlands. These effluents contain dyes, oils, suspended solids, nutrients, pesticides, phenols, and, most importantly, heavy metals (Kanu & Achi, 2011). Heavy metals are recognized as highly toxic due to their non-biodegradable nature and tendency to accumulate in organisms (Jaishankar *et al*., 2014). They enter aquatic systems from domestic sewage, industrial discharges, agricultural runoff, mining, fossil fuel combustion, and wastewater treatment plants (Duruibe *et al*., 2007). Fish are excellent bioindicators of aquatic environmental health because they bioaccumulate contaminants and show physiological, behavioural, and morphological changes in response to pollution (Authman *et al*., 2015).

Heavy metal pollution in rivers gives threat to public water supplies and also to consumer of fishery sources (Terra, 2008). Heavy metals constitute a core group of aquatic pollutants via its bio-accumulative and non-biodegradable properties in food. Human may be contaminated by organic and inorganic pollutants associated to aquatic systems by consumption of contaminated fish and other aquatic foods from this environment (Aderinola *et al*, 2009). Studies on bioaccumulation of pollutants in fish are important in determining different content of trace metal in fish species from bio-magnifications of food chains, metabolic capability and feeding habits (Asuquo *et al*., 2004. The accumulation of metal is a tool for identifying the impact of metal in aquatic ecosystem, and therefore shows an adverse effect in organism

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(Borgmann and Norwood, 1995). Therefore, the present study was carried out to detect the effects of heavy metals in *Channa gachua* (Hamilton, 1822) fishes from Tunia River, Bongaigaon District, Assam, India

MATERIALS AND METHODS

Study area and field sampling

The present study surveyed the Tunia river located in Bongaigaon District and interacted with the fisherman and collected the water and fish sample through netting. The *Channa* species were processed for metal analysis. All the glassware and plastics were soaked overnight in 10% (v/v) nitric acid rinsed with distilled water and deionized water and dried before being used. Five gram of boneless muscle tissue was removed using stainless steel knife and was digested 2:1 Nitric acid and Perchloric Acid mixture (Durali*et al*., 2010).

Sample preparation

The fish sample were preserved in we box during transportation. The fish muscle was sun dried and grinded in grinded mixer and taken into fine powered form. 2.3. Sample extraction: Each sieved sample (0.2 g, 75 µm) was placed in a conical flask and digested with 10 cm^3 of a 2:1 mixture of nitric acid and perchloric acid. The mixture was gently heated until brown fumes disappeared and a clear solution was obtained, then allowed to cool. Distilled water was added, and the solution was filtered through Whatman No. 42 filter paper. The filtrate was made up to 100 ml in a volumetric flask and analysed for Zn, Cu, Pb, Ni, Mn, and Cd using an Atomic Absorption Spectrophotometer (AAS).

Atomic Absorption Spectrometry

The water and fish tissue sample were analysed using Atomic Absorption Spectrophotometry at the Department of Chemistry laboratory of B. Borooah College, Guwahati, Assam. Atomic Absorption Spectrometry (AAS) is a technique for measuring quantities of chemical elements present in environmental samples by measuring the absorbed radiation by the chemical element of interest. This is done by reading the spectra produced when the sample is excited by radiation. The atoms absorb ultraviolet or visible light and make transitions to higher energy levels. Atomic absorption methods measure the amount of energy in the form of photons of light that are absorbed by the sample. A detector measures the wavelengths of light transmitted by the sample, and compares them to the wavelengths which originally passed through the sample. The chemical methods used are based on matter interactions, ie, chemical reactions. For a long period of time these methods were essentially empirical, involving, in most cases, great experimental skills. In analytical chemistry, AAS is a technique used mostly for determining the concentration of a particular metal element within a sample. AAS can be used to analyze the concentration of over 62 different metals in a solution (Atomic Absorption Spectroscopy, 2011)

RESULTS

The comparison among the concentration of heavy metals in the water samples of Tunia river and in fish tissue according to their metal accumulation levels have shown in Table 1 and pic diagram 1 and 2 respectively. Metal accumulation

Table.1. Atomic Absorption Spectroscopy analysis of water and fish tissue of*Channa gachua* (Hamilton, 1822) from Tunia River

Sl. No	Parameters	Results		References	Detection limit
		Water sample	Fish tissue sample		
1	Fe	3.1	9.1	APHA 20th Edition, 3111B	0.001
2	Zn	0.13	2.5	"Do"	"Do"
3	Cd	0.012	0.2	"Do"	"Do"
4	Pb	0.09	2.2	"Do"	"Do"
5	Ni	0.103	1.0	"Do"	"Do"
6	Na	7.4	21.1	"Do"	"Do"
7	K	1.1	57.0	"Do"	"Do"

in decreasing orders in water samples of Tunia river were Na>K>Ni>Zn>Pb>Cd and in fish tissue were found K>Na>Fe>Pb>Ni>Cd.

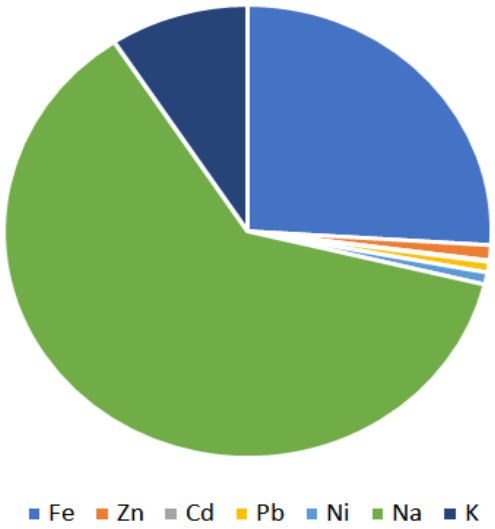

Fig.1. Pie diagram shows the metal concentration (mg/lt) in the water bodies of Tunia river.

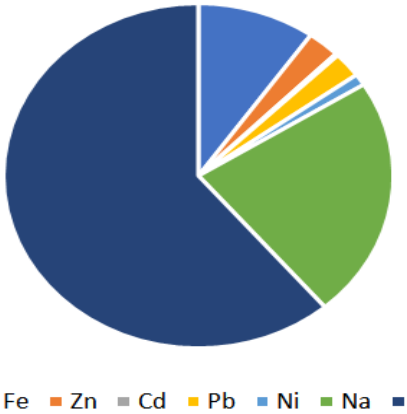

Fig.2. Pie diagram shows the metal concentration (mg/lt) in the fish tissue of Tunia river.

DISCUSSION

The present study reveals the heavy metal concentration in water samples of Tunia river and in fish tissue samples. The data are presented in Table.1 and their concentration are represented in pie diagram. Among the toxic metal, Mn showed highest concentrations in water sample and in tissues of the fish species. It has been reported that excessive Zn intake is detrimental to human health and can cause poisoning, diarrhoea and fever (Obasohan *et al*., 2008). In this study, the highest concentration of Mn was detected 3.1 mg/kg and 9.1mg/kg in river water and fish tissue respectively. Though Pb is a nonessential element for living organism it possesses various deleterious effects such as neuro and nephron toxicity. rapid behavioural malfunction, and decreases the growth, metabolism, and survival rate, alteration of social behaviour in some mammals Garcia-Leston *et al*. (Jayaprakash *et al*., 2015). Another study found that elevated Pb level in fishes obtained from freshwater ecosystem affected by extended agriculture, poultry forms, textile, industrial and other activities (Rashed, 2001). However, the sediments could be the major sources of Pb contamination and the bottom feeders may directly be affected with this deposited element in consequence to their feeding habitat Pb is a neurotoxin that causes behavioural deficits in vertebrates, decreases in survival and growth rates, causes learning disabilities. Therefore, assessment of bioaccumulation such metals may be used as a biomarker of resent lead contaminant on polluted environment. The World Health Organization has recommended that dietary Pb should not exceed 0.3 µg/g (wet weight basis), and with a recommended limit of 450 µg of Pb per day for adults. Cd is not an essential element, and the World Health Organization/Food and Agricultural Organization (WHO/FAO) has determined a maximum tolerable daily intake of 55 µg/(person d). The estimated safe and adequate daily dietary intake of Cr is set at 50-200 µg/d (Chi *et al*., 2007). Like Pb, Cd is also a non-essential element that competes with calcium (Ca) at enzymatic locations in organisms. Cadmium has been found to bioaccumulate most significantly in the kidney followed by liver and gills (Pretto *et al*.,011), and exhibit great nephrotoxic potentials (Gonick *et al*.,2008). It also causes renal-, pulmonary-, hepatic-, skeletal-, and reproductive toxicity effects and cancer Investigation and assessment of metal concentration in muscle tissue is a matter of serious concern as it is the chief edible portion of fish that plays an important role in human nutrition (Yilmaz, 2005, Zhang 2007). A large number of studies (Rajeshkumar 2018; Yu,2012) have shown that the bioaccumulation of heavy metal in fish muscle is significantly correlated with fish species.

CONCLUSION

The results observed in this study were in good agreement with the above consensus. Bioaccumulation is essentially the buildup of heavy metals in living organisms and they absorb contaminants from the water around them faster than their bodies are able to excrete them. High level of heavy metals represents a standard method of bio-monitor of metals present in the surrounding environment. The findings of the present Investigation will be a baseline data of the heavy metal bioaccumulation, which can help in future toxicity. The results of the present study compiled to emphasize the need for a comprehensive biomonitoring program in the study area.

Acknowledgment

We acknowledge the selfless help of Chemistry department, B. Baooah College, Guwahati.

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How to cite this article:

Lutfur Rahman et al .(2025).Studies on effects of Heavy metals in *Channa gachua* (Hamilton, 1822) from Tunia River, Bongaigaon District, Assam, India*. Int J Recent Sci Res*.16(11), pp.594-597.

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