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Cadmium Accumulation in Fish Tissues Under Low Water Level Conditions in the Diyala River /Iraq

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Abstract

Cadmium (Cd) is a toxic heavy metal that can enter aquatic ecosystems through various sources, including agricultural drainage and domestic wastewater. Fish, particularly tilapia, are vulnerable to heavy metal contamination and can serve as important bioindicators of aquatic pollution. The consumption of fish contaminated with elevated levels of cadmium may pose potential health risks to humans. Therefore, this study aims to assess cadmium contamination in the Diyala River under low-water-level conditions. Specifically, the study measures cadmium concentrations in the river water and sediments and investigates its accumulation in the muscles, liver, and gills of tilapia fish. The findings are expected to provide an indication of the extent of cadmium contamination in the river ecosystem and its potential accumulation in aquatic organisms.

1. Introduction

Cadmium (Cd) is a malleable metal in the form of a blueish or silvery-white powder (Suhani *et al.*, 2021). one of the primary sources of protein in human diets is fish. Fish with toxic metals like cadmium were impacted by water pollution, which came from a variety of sources, including unintentional agricultural drainage, domestic wastewater, Tilapia was frequently employed as a bioassay organism in toxicological investigations where it was demonstrated to have the highest sensitivity to harmful effects (Musa *et al.*, 2025) Fish are vulnerable to heavy metal contamination and are the most significant aquatic biota. Therefore, eating contaminated fish that has high levels of metals might have dangerous effects on people (Mahmood, 2021). in this study we are :

1. Measurement of the concentrations of cadmium in water, sediments of Diyala river under low water level condition .
2. Investigation of the concentrations of cadmium in the muscles, liver, and gills of fish (tilapia) under low water level condition .

Keywords: Cadmium Accumulation, Fish Tissues, Tilapias fish, Water Level Conditions.

2. Materials and methods

2.1. Description of the studied area

Baqubah is the center of Diyala Governorate , which located northeast of Baghdad and the seat of government of Diyala governorate .The Diyala river flows through it, dividing it into east and west side The city of Baqubah has unique features that set it apart from other urban places (Kiran, Bharti and Sharma, 2022).. It is the district capital of Baqubah and the provincial capital. Baqubah is a densely populated residential, industrial and commercial city with numerous modes of transit. It includes industrial areas such as the industrial district, gas stations in Diyala. Residential areas such as Haay Al-Mustafa, Al-Tahreer, Haay Al-Moallemen, and Al-Mafraq.

2.2. Tilapias fish (*Oreochromis niloticus*)

Only found in Africa and the Middle East, tilapias are freshwater fish that are members of the Cichlid family (Balami, Sharma and Karn, 2019). One of the earliest fish species to be cultivated worldwide is the Nile tilapia (*Oreochromis niloticus*). Because of scriptural verses concerning the fish being served to the masses ,tilapias have been referred to as "Saint Peter's fish. "Because of their exceptional cultural adaptability, tilapias present a chance for commercialization in a world where captured wild fisheries are becoming more and more scarce . An estimated 1.5 million metric tons of tilapia were produced worldwide in 2000 (Ndiwa *et al.*, 2016).Cadimume was measured in Ibn-Sina company by Atomic absorption spectrometer.

3. Results and Discussion

3.1. Comparison of Cadmium (CD) concentration in fish tissues between the first and second months site 1.

The results showed variations in cadmium (Cd) concentrations among the studied tissues during the first and second months. The highest concentration was recorded in the liver, reaching (0.39±0.0916 ppb) in the first month and (0.417±0.096 ppb) in the second month, followed by the gills, with concentrations of (0.218±0.0228 ppb) and (0.238±0.02 ppb) during the first and second months, respectively, while the lowest concentration was recorded in the muscles, reaching (0.0878±0.018 ppb) in the first month and (0.098±0.019 ppb) in the second month, respectively. as for the control groups, the cadmium

concentrations in the liver, gills, and muscles were 0.253±0.070 ppb and 0.276±0.07 ppb, 0.179±0.0307 ppb and 0.195±0.033 ppb, and 0.05137±0.008 ppb and 0.059±0.008 ppb during the first and second months, respectively.

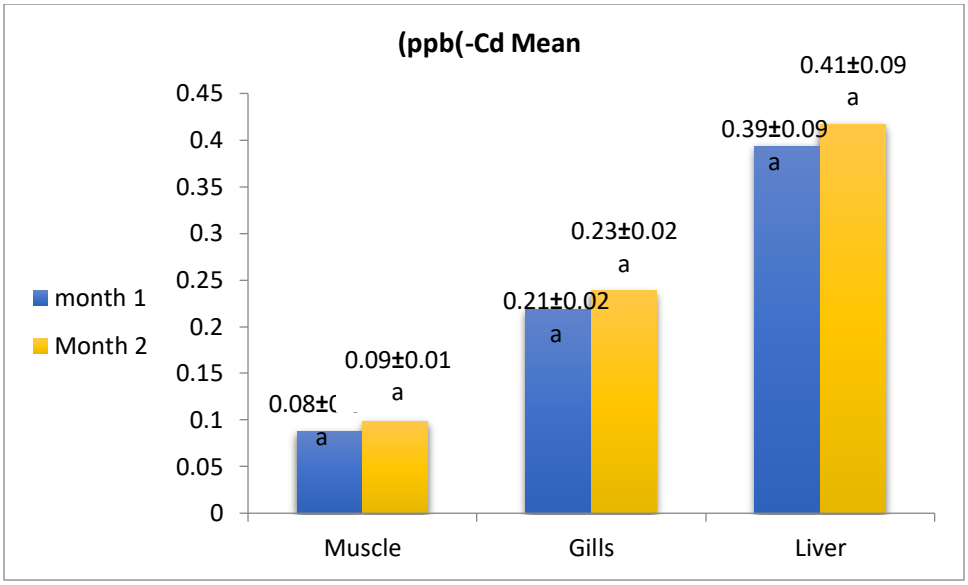

Fig. 1:Tissue Cadmium (CD) concentrations (mean ± SD) across two months site 1

The statistical comparison revealed significant differences between two months site 2 samples and their corresponding control groups for all tissues at $p < 0.05$, as indicated by the different statistical letters (a and b) assigned to the means. The rapid development of industry and agriculture has resulted in an increase in the pollution of rivers and lakes with heavy metals, which have been identified as a significant environmental hazard for invertebrates, fish, and humans. significant quantities of heavy metals in wastewater are discharged into rivers (Lipy *et al.*, 2021). these metals can be substantially accumulated and biomagnified in water, sediment, and aquatic food chains, thus, resulting in sub lethal effects or death in local fish populations (Genchi *et al.*, 2020).

3.2. Comparison Cadmium (CD) concentration in water and sediment between the first and second months.

The results showed relatively similar cadmium (Cd) concentrations in the sediments between the first and second months, with concentrations of (1.094±0.548 ppb) and (1.1418±0.575 ppb), respectively. Similarly, the water samples showed relatively similar Cd concentrations, with values of (0.0237±0.0039ppb) and (0.0325±0.007ppb) during the first and second months, respectively. Figure 2 illustrates this spatial distribution pattern.

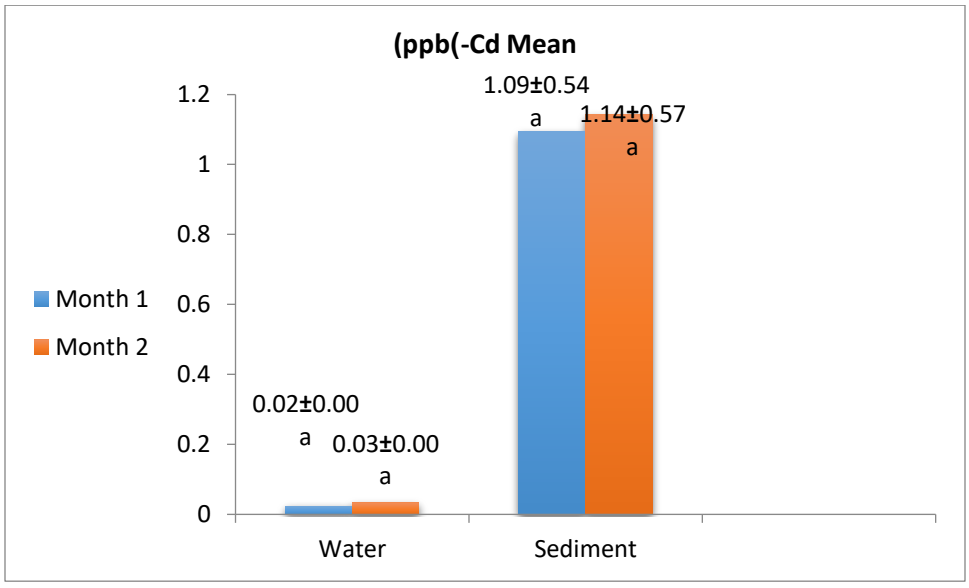

Fig. 2:Cadmium (CD) concentrations (mean ± SD) across in water and sediment two months.

3.3. Comparison Cadmium (CD) concentration control in water and sediment between the first and second months.

The results showed relatively similar cadmium (Cd) concentrations control in water between the first and second months, with concentrations of (0.0248±0.008 ppb) and (0.0248±0.0089 ppb), respectively. Similarly, control sediment samples showed relatively similar Cd concentrations, with values of (1.96±0.0205ppb) and (1.967±0.0205 ppb) during the first and second months, respectively. Figure 3 illustrates this spatial distribution pattern.

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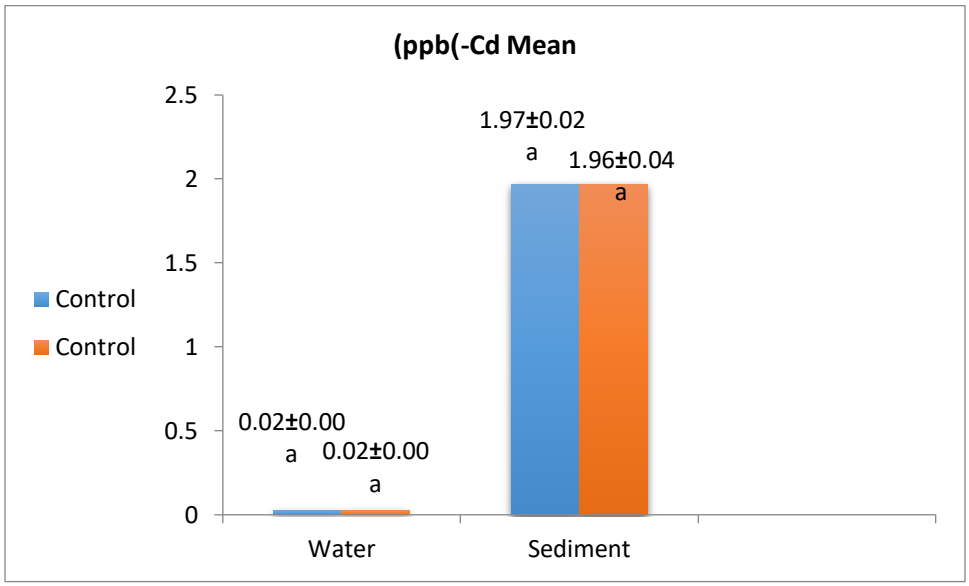
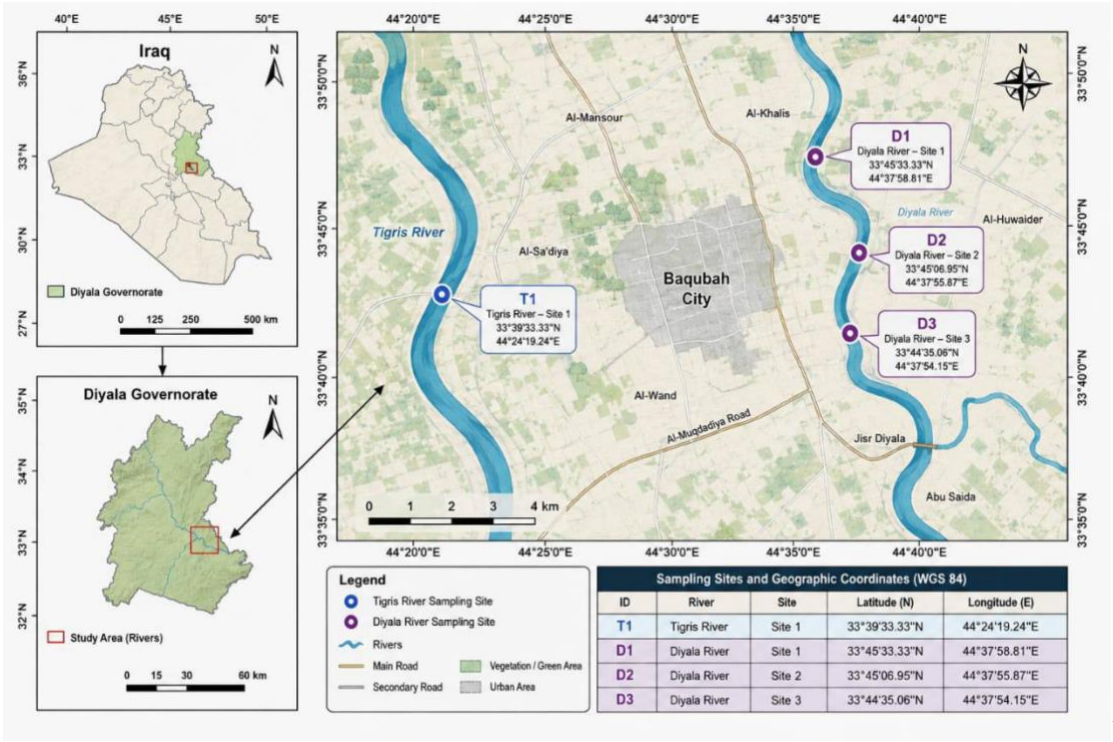


Fig.3: Cadmium (CD) concentrations (mean ± SD) across in control water and control sediment two months.



Map of the Diyala Governorate, showing Baqubah city and sampling sites.

4. References:

Alewy Almashhadany, D., Khalid, H.S. and Ali, H.S. (2020) "Determination of heavy metals and selenium contents in fish meat sold at Erbil City, Kurdistan Region, Iraq," *Italian Journal of Food Safety*, 9(3). Available at: https://doi.org/10.4081/ijfs.2020.8753.

Genchi, G., Sinicropi, M. S., Lauria, G., Carocci, A., & Catalano, A. (2020). The Effects of Cadmium Toxicity. *International Journal of Environmental Research and Public Health*, *17*(11), 3782. https://doi.org/10.3390/ijerph17113782

Isangedighi, I.A. and David, G.S. (2019) "Heavy Metals Contamination in Fish : Effects on Human Health," 2(4), pp. 7–12.

Kiran, Bharti, R. and Sharma, R. (2022) "Effect of heavy metals: An overview," *Materials Today: Proceedings*, 51, pp. 880–885. Available at: https://doi.org/10.1016/j.matpr.2021.06.278.

Kiran, Bharti, R. and Sharma, R. (2022) "Effect of heavy metals: An overview," *Materials Today: Proceedings*, 51, pp. 880–885. Available at: https://doi.org/10.1016/j.matpr.2021.06.278.

Lipy, E. P., Hakim, M., Mohanta, L. C., Islam, D., Lyzu, C., Roy, D. C., Jahan, I., Akhter, S., Raknuzzaman, M., & Sayed, A. (2021). *Assessment of Heavy Metal Concentration in Water , Sediment and Common Fish Species of Dhaleshwari River in Bangladesh and their Health Implications*.

Mahmood, B.A. (2021) "ENVIRONMENTAL PROPERTIES AND ANALYSIS OF THE EUPHRATES RIVER WITHIN ANBAR GOVERNORATE IN IRAQ: A REVIEW," *IRAQI JOURNAL OF DESERT STUDIES*, 11(2), pp. 150–163. Available at: https://doi.org/10.36531/desert.2022.172742.

Musa, A., Nasrin, S., Jakia, T., Sikdar, K., Alam, N., Aktar, S., Sohel, I., & Halder, M. (2025). Heavy metals in water , sediment and fish species of the Bhairab River in southwest Bangladesh and their health implications. *Waste Management Bulletin*, *3*(3), 100237. https://doi.org/10.1016/j.wmb.2025.100237

Ndiwa, T. C., Nyingi, D. W., Claude, J., & Agnèse, J.-F. (2016). Morphological variations of wild populations of Nile tilapia (Oreochromis niloticus) living in extreme environmental conditions in the Kenyan Rift-Valley. *Environmental Biology of Fishes*, *99*(5), 473–485. https://doi.org/10.1007/s10641-016-0492-y

S**uhani, I., Sahab, S., Srivastava, V., & Singh, R. P.** (2021). Impact of cadmium pollution on food safety and human health. *Current Opinion in Toxicology*, *27*, 1–7. https://doi.org/10.1016/j.cotox.2021.04.004.