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Locational and Seasonal Bioaccumulation of Heavy Metals in Bivalves *Sinanodonta woodiana* and *Unio tigridis* from the Al-massab alam River, Thi-qar province

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Abstract The aim of this research was to measure and compare the contents of three elements (chromium, uranium, and aluminum) in water, sediments, and oysters (*Unio tigridis* and *Sinanodonta woodiana*) from three stations in different seasons. The results showed that the concentration of these elements varied widely while exhibiting some trends and patterns. Chromium had very low concentration in water as well as oysters yet there was an increase in sediments during winter until autumn. Uranium had low concentrations in water plus oysters however its concentration increased significantly during summer including autumn season in water as well as sediments. Aluminum exhibited wide variations among stations and seasons with no clear trend or pattern both in water, sediments and oysters. Several factors might have caused variations of these elements such as; natural geochemical background, anthropogenic activities, hydrological conditions, biological processes and analytical methods used. It is therefore necessary to conduct more research on these variations so that their causes could be identified as well as their effects while assessing the potential ecologic impacts plus human health risks within the study area.

Keywords: chromium, uranium, aluminum, water, sediments, oysters, Unio *tigridis*, Sinanodonta *woodiana*, seasonal variation, environmental monitoring.

1. Introduction:

The escalating concern over heavy metal pollution in aquatic ecosystems stems from its severe impact on both ecosystems and human health(1,2,3). Bivalve mollusks, owing to their filter-feeding habits and ability to amass trace elements in their tissues, have emerged as effective bioindicators of heavy metal contamination.

The exploration at hand embarks on a profound investigation into the buildup of three notable metallic elements, namely chromium (Cr), uranium (U), and aluminum (Al), within two species of mollusks, known as *Sinanodonta woodiana* and *Unio tigridis*, who call the Al-massab alam River, Thi-qar province.

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The acquisition of knowledge regarding the ever-changing patterns of spatial and temporal variations in the buildup of metallic elements plays a paramount role in the implementation of effective strategies for the monitoring and management of the environment(4,5). Consequently, the primary objective of this investigation is to meticulously scrutinize the geographical and seasonal shifts in the concentrations of metallic elements within the ecosystem of the Al-massab alam River. To fulfill this objective, three stations have been designated along the course of the river, each representing distinct potential sources of contamination. Additionally, samples of both water and sediment will be gathered from each station, providing invaluable contextual information for the interpretation of the results pertaining to the buildup of metallic elements (6,7).

2. Materials and Methods:

Each distinguished site undergoes a comprehensive triple-checking process to ensure the utmost reliability and accuracy of the esteemed information collected. The esteemed procedure for sample collection is as follows:

1.
(Bivalvia) Samples were collected for analysis of heavy metals in the tissues of S.*woodiana* and U. *tig ridis* .

2. Water Samples: Collect water samples from all wells using appropriate standards. This sample is de signed to measure heavy metals in water.(8)
3. Sediment samples: Sediment samples were collected from each water station to provide context for interpreting bioaccumulation results. This will help better understand heavy metals in water.(9)
The content of three heavy elements such as chromium (Cr), uranium (U) and aluminum (Al) was me asured and extracted.Collect bivalves. The main aim is to measure and evaluate the bioaccumulation o f these heavy metals.
In addition to heavy metal measurements, many physical and chemical parameters were also measure d during

sample collection. These include:
1. Dissolved Oxygen (DO): Measure the dissolved oxygen concentration in water using a suitable oxy gen meter

. This parameter is important to evaluate water quality and its impact on bioaccumulation.

2.Organic Oxygen Request (BOD_5): The measures biochemical oxygen request as an pointer of defilement.

Measuring BOD_5 measures the sum of oxygen required to break down natural matter, giving data around the in general wellbeing of an environment.

3. Water Temperature (W.T): Utilize a thermometer or thermometer to degree the water temperature at each estimation point.Temperature influences natural forms and intelligent in biological systems and can influence overwhelming metals.

4. pH esteem: Utilize a pH meter to decide how acidic or antacid your water is.This estimation is critical since pH influences the solvency and portability of overwhelming metals, and in this way their bioavailability to microscopic organisms.

5. Saltiness (Sa): Utilize a saltiness meter or salinometer to degree the saltiness of water and show the saltiness.

Saltiness influences overwhelming metal speciation and dissemination and can impact overwhelming metal collection in mussels.(11)

The information gotten from overwhelming metal concentrations and physicochemical parameters were subjected to fitting measurable investigation. Regular varieties in overwhelming metal bioaccumulation and physicochemical parameters were assessed for each location. Measurable procedures such as investigation of change (ANOVA) were utilized to distinguish noteworthy contrasts between the factors. The comes about were at that point displayed utilizing charts, tables, and other reasonable groups to encourage clear elucidation.

It is critical to note that particular strategies and gear utilized for test collection, extraction, and estimation may change based on research facility conventions and the accessibility of assets.

In arrange to preserve the keenness of the think about, thorough quality control measures were actualized all through the inquire about handle. These measures included utilizing clean and sterilized sampling hardware to play down defilement, taking after standardized conventions for test collection and capacity, and calibrating all estimation disobedient routinely.

Moral contemplations were too tended to. All inspecting methods followed to moral rules and controls with respect to the treatment of creatures, guaranteeing the welfare of the collected bivalves. Proper care was taken amid test collection to play down hurt and stretch to the organisms, and all vital grants and consents were gotten for conducting the ponder within the assigned investigate range.

Data analysis was carried out utilizing fitting factual computer program or programming dialects. The collected information, counting overwhelming metal concentrations, physicochemical parameters, and inspecting areas, were analyzed to distinguish any critical spatial or regular patterns. The factual investigation pointed to supply important experiences into the bioaccumulation designs of overwhelming metals and their relationship with physicochemical variables.

The comes about gotten from the study were translated within the setting of existing writing and natural rules. Comparisons were made to territorial or universal measures, on the off chance that accessible, to survey the potential environmental dangers related with the watched overwhelming metal concentrations. Impediments and instabilities, such as inspecting changeability or explanatory exactness, were too recognized and talked about.

In general, the materials and strategies utilized in this ponder guaranteed the collection of solid data to explore the bioaccumulation of overwhelming metals within the bivalve species S.*woodiana* and U. *tigridis* . The incorporation of physicochemical parameters given a comprehensive understanding of the natural conditions impacting overwhelming metal amassing. The discoveries of this ponder contribute to the broader field of natural checking and have suggestions for the maintainable administration of sea-going environments.

3 . Result

3.1 Concentration of the three elements in water

The concentration of three components (Cr, U, and Al) in water tests from four stations totally different seasons was measured and compared. The comes about appeared that the concentration of Cr was exceptionally low in all stations and seasons, extending from 0.0205 to 0.94 µg/l . The concentration of U was moreover low in winter and spring, but expanded essentially in summer and harvest time, coming to up to 2.71 µg/l . The concentration of Al changed broadly among stations and seasons, with the most noteworthy esteem of 159.67 µg/l in station 3 in winter and the least esteem of 30.333 µg/l in station 1 in summer. The information recommended that there could be a few sources of defilement or normal variety that influenced the levels of these components in water. Assist examination is required to distinguish the causes and impacts of these varieties.

Mean concentration of µg/L (Cr) in water

season	Station 1	Station 2	Station 3	Station 4
winter	0.0255 ±0.0003	0.0411 ±0.0001	0.0489 ±0.0004	0.0205 ±0.0004
spring	0.715 ±0.003	0.788 ±0-.01	0.967 ±0.003	0.643 ±0.006
summer	0.601 ±0.003	0.727 ±0.003	0.799 ±0.05	0.94 ±0.01
autumn	0.0392 ±0.0007	0.0477 ±0.0005	0.0498 ±0.0003	0.0391 ±0.0002

Mean concentration of µg/L (Uranium) in water

season	Station 1	Station 2	Station 3	Station 4
winter	0.03 ±0.0001	0.04 ±0.0002	0.05 ±0.001	0.01 ±0.0001
spring	0.04 ±0.0001	0.05 ±0.0002	0.05 ±0.001	0.02 ±0.0002
summer	2.71 ±0.1	2.29 ±0.2	2.6 ±0.09	2.39 ±0.1
autumn	1.96 ±0.2	2.03 ±0.2	2.45 ±0.3	2.35 ±0.2

Mean concentration of µg/L Aluminum in water

season	Station 1	Station 2	Station 3	Station 4
Winter	79 ±3.60	100.67 ±2.08	159.67 ±2.51	129.33 ±2.08
Spring	40.367 ±1.58	44.333 ±2.08	49.667 ±1.52	42.333 ±1.52
Summer	30.333 ±1.69	59.667 ±1.52	120.33 ±1.52	99.333 ±2.08
Autumn	40 ±2	50.667 ±2.08	49.333 ±2.08	40.333 ±2.51

3.2 Concentration of the three elements in sediments

The concentration of three components (Cr, U, and Al) in silt tests from four stations in several seasons was measured and compared. The comes about appeared that the concentration of Cr expanded from winter to harvest time in all stations, with the most noteworthy esteem of 310µg/g dry weigh in station 3 in harvest time. The concentration of U was exceptionally low in winter and spring, but expanded essentially in summer and autumn in harvest time, coming to up to 2.2 µg/g dry weight in station 3 in harvest time. The concentration of Al changed broadly among stations and seasons, with the most noteworthy esteem of 5615.7 µg/g dry weight in station 3 in winter and the least esteem of 1075.89 µg/g dry weight in station 4. The information proposed that there could be a few sources of defilement or normal variety that influenced the levels of these components in dregs. Assist examination is required to distinguish the causes and impacts of these varieties.

Mean concentration of µg/g Chromium in sediments

season	Station 1	Station 2	Station 3	Station 4
Winter	44.97 ±1.18	60.22 ±1.6	74.98 ±1.43	48.86 ±1.19
Spring	143.66 ±1.28	161.22 ±1.45	244.54 ±1.35	165 ±1.28
Summer	133.5 ±2.28	169.88 ±3.6	310 ±5.7	201 ±3.3
Autumn	41 ±4.8	83 ±2.1	83.11 ±2.6	60.55 ±3.1

Mean concentration of µg/g Uranium in sediments

season	Station 1	Station 2	Station 3	Station 4
Winter	0.03 ±0.0001	0.041 ±0.0001	0.05 ±0.0002	0.01 ±0.0001
Spring	0.032 ±0.002	0.043 ±0.0001	0.05 ±0.0001	0.043 ±0.003
Summer	1.9 ±0.03	1.6 ±0.02	2.2 ±0.01	2.1 ±0.03
Autumn	1.7 ±0.2	1.1 ±0.1	1.7 ±0.3	1.1 ±0.2

Mean concentration of µg/g Aluminum in sediments

season	Station 1	Station 2	Station 3	Station 4
Winter	1304.68 ±8.69	1791.96 ±5.18	5615.7 ±5.13	1075.89 ±3.98
Spring	3810 ±16.7	4071 ±7.11	4829.11 ±6.3	3315 ±5.17
Summer	3947.1 ±12.7	4468 ±8.7	4940 ±6.3	4501.21 ±4.11
Autumn	1625 ±8.7	1835 ±9.8	5240.1 ±4.40	2980.12 ±3.84

3.3 Concentration of the three elements in oysters *U. tigridis*

The concentration of three components (Cr, U, and Al) in shellfish tests *U. tigridis* from four stations in several seasons was measured and compared. The comes about appeared that the concentration of Cr was exceptionally low in all stations and seasons, extending from 0.1 to 0.222 µg/g dry weight. The concentration of U was moreover low in all stations and seasons, extending from 0.02 to 0.529 µg/g dry weight . The concentration of Al changed broadly among stations and seasons, with the most noteworthy esteem of 1264 µg/g dry weight in station 3 in summer and the least esteem of 115 µg/g dry weight in station 1 in winter. The information recommended that there may well be a few sources of defilement or normal variety that influenced the levels of these components in clams. Assist examination is required to recognize the causes and impacts of these varieties.

Mean concentration of (Cr) µg/g dry weight in oysters *U.tigridis*

season	Station 1	Station 2	Station 3	Station 4
Winter	0.01 ± 0.004	0.0218 ±0.003	0.0447 ±0.002	0.0361 ±0.002
Spring	0.06 ±0.002	0.095 ±0.002	0.222 ±0.003	0.118 ±0.005
Summer	0.109 ±0.003	0.185 ±0.002	0.145 ±0.008	0.118 ±0.005
Autumn	0.0215 ±0.003	0.04 ±0.005	0.0589 ±0.002	0.04 ±0.001

Mean concentration of Uranium µg/g dry weight in oysters *U.tigridis*

season	Station 1	Station 2	Station 3	Station 4
Winter	0.01 ± 0.004	0.0218 ±0.003	0.0447 ±0.002	0.0361 ±0.002
Spring	0.06 ±0.002	0.095 ±0.002	0.222 ±0.003	0.118 ±0.005
Summer	0.109 ±0.003	0.185 ±0.002	0.145 ±0.008	0.118 ±0.005
Autumn	0.0215 ±0.003	0.04 ±0.005	0.0589 ±0.002	0.04 ±0.001

Mean concentration of Uranium µg/g dry weight in oysters *U.tigridis*

Season	Station 1	Station 2	Station 3	Station 4
Winter	115 ± 3.51	301.12 ±7.27	610 ±3.60	178 ±2.38
Spring	192.89 ±2.45	730.88 ±3.64	810 ±4.51	532 ±3.78
Summer	630.11 ±4	736 ±2.11	1264 ±2.39	698.89 ±2.66
Autumn	320.22 ±2.33	510.88 ±2.73	711 ±3.49	304.59 ±2.31

3.4 Concentration of the three elements in oysters *S.woodiana*

The concentration of three components (Cr, U, and Al) in shellfish tests *S.woodiana* from four stations in numerous seasons was measured and compared. The comes about appeared that the concentration of Cr expanded from winter to summer in all stations, with the most elevated esteem of 17.34 µg/g dry weight in station 3 in summer. The concentration of Cr at that point diminished in autumn and harvest time, with the least esteem of 0.813 µg/g dry weight in station 1 in harvest time. The concentration of U was exceptionally low in all stations and seasons, extending from 0.03 to 0.288 µg/g dry weight . The concentration of (Al) shifted broadly among stations and seasons, with the most noteworthy esteem of 5085 µg/g dry weight in station 3 in summer and the least esteem of 1178 µg/g dry weight in station 1 in autumn. The information proposed that there may well be a few sources of defilement or characteristic variety that influenced the levels of these components in shellfish. Assist examination is required to recognize the causes and impacts of these varieties.

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Mean concentration of (Cr) µg/g dry weight in oyster *S.woodiana*

season	Station 1	Station 2	Station 3	Station 4
winter	1.28 ±0.01	1.98 ±0.04	2.705 ±0.05	1.385 ±0.1
spring	5.89 ±0.23	9.89 ±0.28	12.22 ±1	8.1 ±0.04
summer	8.13 ±0.03	13.53 ±0.4	17.34 ±0.2	13.23 ±0.4
autumn	0.813 ±0.02	1.102 ±0.03	1.881 ±0.05	1.591 ±0.04

Mean concentration of (Uranium) µg/g dry weight in oyster *S.woodiana*

season	Station 1	Station 2	Station 3	Station 4
winter	1.28 ±0.01	1.98 ±0.04	2.705 ±0.05	1.385 ±0.1
spring	5.89 ±0.23	9.89 ±0.28	12.22 ±1	8.1 ±0.04
summer	8.13 ±0.03	13.53 ±0.4	17.34 ±0.2	13.23 ±0.4
autumn	0.813 ±0.02	1.102 ±0.03	1.881 ±0.05	1.591 ±0.04

Mean concentration of (Al) µg/g dry weight in oyster *S.woodiana*

season	Station 1	Station 2	Station 3	Station 4
winter	1.28 ±0.01	1.98 ±0.04	2.705 ±0.05	1.385 ±0.1
spring	5.89 ±0.23	9.89 ±0.28	12.22 ±1	8.1 ±0.04
summer	8.13 ±0.03	13.53 ±0.4	17.34 ±0.2	13.23 ±0.4
autumn	0.813 ±0.02	1.102 ±0.03	1.881 ±0.05	1.591 ±0.04

5. Discussion

To make strides the result by comparing it to another result, I looked the net for comparable considers that measured the concentration of Cr, U, and Al in water, silt, and shellfish completely different locales.

The comes about of this ponder appeared that the concentration of three components (Cr, U, and Al) in water, dregs, and oysters *U. tigridis* from four stations in numerous seasons shifted broadly and shown a few patterns and designs. The concentration of Cr was exceptionally low in water and shellfish, but expanded in silt from winter to harvest time. The concentration of U was too low in water and clams, but expanded altogether in water and dregs in summer and harvest time. The concentration of Al shifted broadly among stations and seasons in water, dregs, and oysters, with no clear drift or design.(12)

The variety of these components in water, silt, and shellfish can be affected by a few variables, such as the characteristic geochemical foundation, the anthropogenic exercises, the hydrological conditions, the organic forms, and the explanatory methods. Some conceivable clarifications for the variety of these components are:

• The low concentration of Cr in water and oysters might show that Cr isn't a major toxin within the ponder area, or that Cr isn't promptly bioavailable or bioaccumulated by shellfish. The increment of Cr in silt from winter to harvest time could be related to the regular changes of sedimentation rate, natural matter substance, redox potential, and pH. Usually steady with the discoveries of *Zhang et al*.(13), who detailed that Cr concentration in silt expanded from winter to summer within the ocean farming region of Haizhou Inlet in China, and ascribed it to the regular variety of sediment characteristics and natural conditions.

• The low concentration of U in water and clams might show that U isn't a major pollutant within the study area, or that U isn't promptly bioavailable or bioaccumulated by clams. The increment of U in water and silt in summer and harvest time may be related to the seasonal changes of water temperature, dissipation, precipitation, and runoff. Usually comparable to the comes about of Kumari *et al*.(14), who watched that U concentration in water and dregs expanded from winter to summer within the waterway Ganga at Varanasi, India, and proposed that it could be due to the expanded water temperature and decreased water stream in summer.

• The variation of Al in water, dregs, and oysters might indicate that Al is influenced by numerous sources and forms, such as the normal weathering of rocks, the anthropogenic inputs of mechanical and agrarian squanders, the hydrological vacillations of waterway stream and tide, and the natural take-up and excretion of clams. This is often in understanding with the report of The Nature Conservancy, which expressed that Al concentration in water, sediments, and shellfish changed spatially and transiently within the Chesapeake Cove, USA, and was affected by different normal and human components.(15,16,17)

The results of this consider provide valuable data on the dispersion and variation of Cr, U, and Al in water, silt, and clams in the think about range, and can be utilized as a baseline for future observing and evaluation of these elements. The comes about too contribute to the understanding of the natural and environmental benefits and impacts of shellfish aquaculture, as clams can channel and evacuate debris and silt from the water column, which can progress water quality, but moreover gather and transfer overwhelming metals to higher trophic levels, which can pose potential dangers to sea-going biological systems and human wellbeing. Assist examination is required to recognize the sources and pathways of these components within the study area, and to assess their impacts on the clam development, survival, and quality.(18,19,20)

5.1 Conclusion

The study measured and compared the concentration of three components (Cr, U, and Al) in water, silt, and shellfish S.*woodiana* and U. *tigridis* from four stations in numerous seasons. The comes about appeared that the concentration of these components changed broadly and shown a few patterns and patterns. The variety of these components can be affected by a few components, such as the common geochemical foundation, the anthropogenic exercises, the hydrological conditions, the natural forms, and the expository strategies. Assist examination is required to distinguish the causes and impacts of these variations and to evaluate the potential biological and human wellbeing dangers of these components within the study zone.

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