

Health Risk Assessment of Mercury, Cadmium, and Lead in Green Mussel (*Perna viridis*) and Oyster (*Crassostrea iredalei*) harvested in Bolinao, Pangasinan, Philippines



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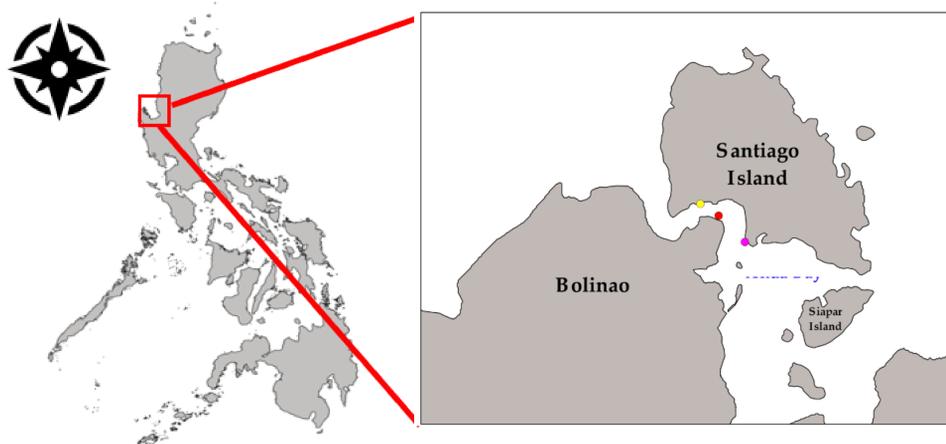
1 Introduction

Heavy metals are naturally occurring elements which are toxic even in trace amounts. Rapid urbanization, industrial, domestic, agricultural, medical and technological applications have led to its wide distribution in the environment which raises concerns over their potential effects. Bivalves accumulate heavy metals from food, water, and sediments which can be harmful to human health.

Thus, in the present study, oyster, mussel, and water samples were collected during the dry and wet season of 2023 from the aquaculture farms in Bolinao, Pangasinan and were analyzed for mercury (Hg), cadmium (Cd) and lead (Pb).



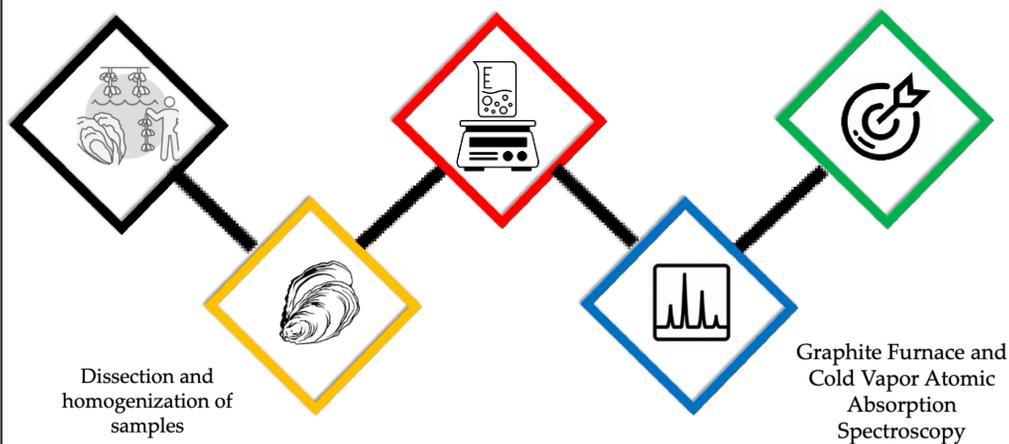
2 Methodology



Collection of samples

Digestion of samples

Quality Assurance and Quality Control



3 Results and Discussion

Table 1. Heavy metals concentrations of bivalves and water samples collected from Bolinao, Pangasinan (wet and dry season of 2023).

Commodity	Season	Hg		Cd		Pb	
		Bivalve	Water	Bivalve	Water	Bivalve	Water
Green Mussel	Dry	<0.0173	<0.0010	0.073±0.0041	<0.0020	0.0110±0.0024	<0.0004
	Wet	<0.0173	<0.0010	0.0076±0.0011	<0.0020	<0.0480	<0.0004
Oyster	Dry	<0.0173	<0.0010	0.0356±0.0063	<0.0020	0.0053±0.0012	<0.0004
	Wet	<0.0173	<0.0010	0.0346±0.0066	<0.0020	<0.0480	<0.0004
Limit for bivalve, mg/kg (EU 2023/915)		0.50	--	1.00	--	1.50	--
Limit for water, mg/L (DAO 2016-08, Class SB)		--	0.002	--	0.05	--	0.01

Table 2. Estimated daily intake of residents from Brgy. Luciente I, Bolinao, Pangasinan.

Commodity	Season	Estimated Daily Intake (mg/kg day ⁻¹)	
		Cd	Pb
Green Mussel	Dry	1.01 x 10 ⁻⁸	1.51 x 10 ⁻⁸
	Wet	1.05 x 10 ⁻⁸	--
Oyster	Dry	1.82 x 10 ⁻⁴	2.65 x 10 ⁻⁵
	Wet	4.62 x 10 ⁻⁸	--
Oral reference dose, mg/kg day ⁻¹ (US EPA 2016: Regional Screening Level)		0.001	0.001

Collected bivalves did not exceed the regulatory limit set by (EU) 2023/915 for Hg, Cd and Pb. Additionally, water samples collected were within the regulatory limit set for Hg, Cd and Pb of Class SB waters by the Department of Environment and Natural Resources Administrative Order 2016-08 (see table 1). Meanwhile, there was no risk associated with the consumption of bivalves based on the computation for Estimated Daily Intake, Hazard Quotient, and Carcinogenic Risk (see tables 2 and 3).

Table 3. Hazard Quotient and Carcinogenic Risk of Cadmium from the consumption of bivalves.

Commodity	Season	Health Risk assessment			
		Hazard Quotient		Carcinogenic Risk (mg/kg day ⁻¹)	
		Cd	Pb	Cd	Pb
Green Mussel	Dry	1.01 x 10 ⁻⁵	1.51 x 10 ⁻⁵	1.51 x 10 ⁻⁷	1.29 x 10 ⁻¹⁰
	Wet	1.05 x 10 ⁻⁵	--	1.57 x 10 ⁻⁷	--
Oyster	Dry	0.1823	0.0265	0.0027	2.25 x 10 ⁻⁷
	Wet	4.62 x 10 ⁻⁵	--	6.93 x 10 ⁻⁷	--
Limit for Hazard Quotient, <1 (EPA IRIS, 1991)		<1	<1	--	--

4 Conclusion

Samples collected passed the allowable limit of Hg, Cd, and Pb as set by the regulatory bodies. None of the studied bivalve showed higher daily intakes than the oral reference dose. Furthermore, Hazard Quotient were <1 thus, no health risk associated in the consumption of bivalves. The study however, focused only on two bivalves and does not include other species from the aquaculture farms around the Bay. Despite the absence of risk associated in the consumption of bivalves, implementation of environmental laws and policies related to the wastewater discharge into the aquatic systems should be strictly enforced and continuous monitoring should be conducted.

5 References



To review the references used in this study, please scan the following QR Code or access thru: <https://cdn2.meqr.com/pdf.17589139.pdf>

6 Acknowledgement

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