

Detection of heavy metals in *Batissa angulata* (Clams) from two selected Barangay of Mondragon, Northern Samar, Philippines

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Abstract

This study was conducted to detect presence of heavy metals (As, Pb, Hg) in *Batissa angulata* (Clams) obtained from two selected barangays of Mondragon, Northern Samar, Philippines. Physical properties of clam's meat samples were also determined.

Clams meat extract from Brgy Cablangan are darker in color as compared to calm samples from Brgy Talolora. Both clams' extracts have rotten egg odor and are miscible in water and ethanol but immiscible in hexane. The heavy metals in samples were analyzed using qualitative and quantitative procedures. Results showed that only mercury (Hg) metal contamination was detected from clam's meat extract from Brgy Cablangan. Quantitative analysis using Atomic Absorption Spectrophotometer (AAS) revealed mercury concentration of < 0.002 mg/L. The said mercury concentration is below the permissible level set by the International Standard Maximum Permissible Level (MPL). The researcher recommends that every barangay promotes information and educational campaign on local residents on proper waste disposal to avoid further contamination of marine products.

Keywords: heavy metals, clams, detection

1. Introduction

Clams (locally known as "Bebe" in Northern Samar) are members of the invertebrate class Bivalves that usually live in sandy or muddy bottoms. Clams are common table food by Nortehanons. A three-ounce serving of cooked clams, or about nine small clams, has about 24 milligrams of iron. It is easily more digestible compared to other meats such as beef and pork. Clams are a good source of phosphorus, potassium, zinc, copper, manganese, and selenium (Britannica, 2015). Nowadays, many of these living creatures found in freshwater environment are contaminated by heavy metals.

Heavy metal refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations. These are found naturally in the earth, and become concentrated as a result of human caused activities. Humans are exposed to heavy metals through inhalation of air pollutants, consumption of contaminated drinking water, exposure to contaminated soils or industrial waste, or consumption of contaminated food.

Chronic exposure to these heavy metals can have serious health consequences including reduced growth and development, cancer, organ damage, nervous system damage, and in extreme cases, death. Examples of heavy metals that are harmful to humans include mercury, lead and arsenic.

2. Materials and Methods

2.1 Preparation of the Sample

Clam samples were gathered from two Selected Barangays in Mondragon, Northern Samar. Five (5) kilos of clam samples were obtained from Brgy Cablangan and seven (7) kilos from Brgy Talolora. Clam samples were cleaned, thoroughly blended and made into liquid consistency.



Fig 1: Clams from Sampling Sites

2.2 Physical Properties Determination

The physical properties of samples like boiling point, color, density, odor, pH and solubility were determined using standard procedures. All evaluations were done in three trials. Solubility of meat extract was tested against three solvents: hexane, water and ethanol.

2.3 Qualitative Detection of As, Pb and Hg

Qualitative Detection of Heavy Metals procedure by Yoger, C. (2010) [7], was used in detecting the presence of heavy metals.

Arsenic (As)

To the prepared clam samples solution, 3F HCl was added

until it is barely acid. It was centrifuged for 3 minutes, and then the centrifugate was discarded. Then, on the residue, 10 drops of concentrated HCl was added. The solution was then stirred and heated in a hot water bath for 1 minute and then the centrifugate was removed.

The residue was washed with a mixture of 8 drops of water and 4 drops of concentrated HCl. It was then centrifuged and added to the centrifugate of the concentrated HCl treatment. The residue and the centrifugate were separated.

The residue was washed with hot water for three times, then 4 drops of concentrated HNO₃ was added, and heated for 5 minutes in water bath.

After heating, 5 drops of 0.5F AgNO₃ was added and then stirred. To clear the centrifugation, 15 drops of 2.5F NaAc solution was added. The formation of a reddish-brown precipitate indicates the presence of arsenic.

Lead (Pb)

Although PbCl₂ is insoluble at room temperature, its solubility is increased dramatically at higher temperatures; it dissolves readily in boiling water, Pb²⁺ also forms an insoluble white sulfate, which dissolves in a solution containing acetate ion due to the formation of the weak electrolyte, Pb(CH₃COO)₂. The addition of chromate ion to this lead acetate solution yields a precipitate of yellow lead chromate.

To the clams solution 3M HCl was added drop wise. (A large excess of HCl must be avoided because of the formation of the soluble chloro complex, PbCl₄²⁻.) Centrifuged and the supernatant liquid from the white precipitate were removed.

Hot water was added to the precipitate and then stirred. If the precipitate dissolves, Pb²⁺ is indicated. To the hot solution 3M H₂SO₄ was added. Centrifuged and the supernatant liquid from the white precipitate (PbSO₄) were removed.

To the precipitate, 3M NH₄CH₃COO was added and then stirred. A few drops of 0.5M K₂CrO₄ were added to the solution. A yellow precipitate of PbCrO₄ indicates the presence of Pb²⁺.

Mercury (Hg)

When Hg₂Cl₂ is treated with aqueous NH₃ a reaction occurs in which free mercury and amino chloro mercury (II) are formed.

About 2 mL of the prepared clam samples solution was used in the detection of mercury ions in the clam samples.

To the prepared clam samples solution 3M HCl was added. If a white precipitate forms, it was centrifuged and the supernatant liquid removed. Then, to the precipitate, 6M NH₃ was added and stirred. The appearance of gray to black precipitate is positive to mercury ion.

2.4 Quantitative analysis of amounts of heavy metals

To measure the total quantity of heavy metals that are found in the clam samples, positive samples were forwarded to the Mach Union Water Laboratory Incorporation, Las Pinas City, using Atomic Absorption Spectrophotometer (A.A.S). Data from the Mach Union Water Laboratory Incorporation were collected and analyzed for proper interpretation and conclusion.

A blank of 100 mL DI (De-ionized) water, 100 mL of 1.5ppb control and 100 mL of clam meat extract were placed into 250 mL Erlenmeyer flasks. A 5 mL of conc. H₂SO₄, 2.5 mL

of conc. HNO₃ and 15 mL of conc. KMnO₄ solution were added to each flask. Then, mixed and let stand for 15 minutes. Additional potassium permanganate was added as necessary, until purple color persists. Then, 8 mL of K₂S₂O₈ solution was added to each flasks and heated for 2 hours in a water bath at 90°C to 95°C.

FIAS 100

About 6 mL of NaCl- Hydroxylamine Hydrochloride was added to each digested solution. Aspirate each of the digested solution using blank solution, calibration solution or test sample solution.

3. Results & Discussion

This study determined the physical properties of clams' meat extracts in terms of boiling point, color, density, odor, pH and solubility. Table 1 shows the average results of the different analysis done on the two sampling sites.

Table 1: Physical Properties of Clam Extract

Physical Properties	Barangay Cablangan	Barangay Talolora
Boiling Point	64.67°C	73.33°C
Color	Dark green	Mossy green
Density	0.95 g/mL	0.93 g/mL
Odor	Rotten egg	Rotten egg
pH	4.53	4.13
Solubility		
Ethanol	Miscible	Miscible
Hexane	Immiscible	Immiscible
Water	Miscible	Miscible

The boiling point of clam's meat extract from Brgy Cablangan is lower than the samples obtained from Brgy Talolora. The color of clam extracts from the two sites also differs. Sample from Brgy Cablangan is dark green while mossy green color in Brgy Talolora. Clam samples from Brgy Cablangan are darker in color as compared to clam samples from Brgy Talolora. Samples from Brgy Cablangan has higher density and pH. Both samples have unpleasant rotten egg-like odors, moderately acidic, miscible in water and alcohol and immiscible in hexane.

Each clam samples from the two sampling sites were cleaned and weighed. Clams meat were used and made into a solution and was tested for heavy metals using the procedure from Yoger, C. (2010) [7]. Presence of mercury is indicated by the formation of a black or grey precipitate. Arsenic is detected by the formation of reddish-brown precipitate and lead showed a yellow precipitate. Results of qualitative tests are shown in Table 2.

Table 2: Presence of Heavy Metals in Samples Using Qualitative Analysis

Heavy Metals	Barangay Cablangan	Barangay Talolora
Arsenic (As)	Negative	Negative
Lead (Pb)	Negative	Negative
Mercury (Hg)	Positive	Negative

The result of the study showed that only mercury metal contamination is detected from clam samples taken from Brgy Cablangan. Arsenic and Lead are negative in clam samples that are collected from two barangays.

Clam samples from Brgy Cablangan that were positive for mercury contamination were forwarded to the Mach Union

Water Laboratory Incorporation to quantify the concentration. Cold vapor AAS revealed that the average concentration of Mercury (Hg) from Barangay Cablangan were observed to be 0.002 mg/L. It was evident from this study that the heavy metal mercury (Hg) accumulations in *Batissa angulata* (Clams) were low and not yet in an alarming amount. Such value is below permissible level set by the international standard Maximum Permissible Level (MPL).

4. Conclusion

From the data gathered throughout the conduct of this study, the following conclusions were formulated by the researchers:

- Physical properties of clams sample from the two barangays are almost similar except on noticeable difference on boiling points. Samples from Brgy Talolora has a higher boiling point than samples from Brgy Cablangan.
- Only mercury contaminant was found in clam samples coming from Barangay Cablangan, Mondragon, Northern Samar
- Atomic Absorption Spectrophotometric analysis of mercury from clam meat extract coming from Brgy. Cablangan, revealed concentrations that are below permissible limit.

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