QUALITATIVE TEST OF HEAVY METALS IN *Chanos chanos*

ABSTRACT

The *Chanos chanos* is an aquatic animal that is commonly used as a food resource because of its good taste and great demand in the market. It is also known as the national fish of the Philippines. This study was conducted to determine the heavy metals found in *Chanos chanos* in terms of Arsenic (As), Cadmium (Cd), Chromium (Cr), and Lead (Pb). Samples were collected from San Jose, Northern Samar,Philippines. Physical properties of the sample in terms of its pH and solubility werealso determined. Results showed that the *Chanos chanos* tested positive for theLead heavy metal and is found in the belly part of the fish. The pH level of *Chanos chanos* extract is acidic, while it is soluble in water and methanol, and insoluble to the toluene. It can be noted that the presence of these heavy metals indicates contamination of the marine resources, hence, a thorough policy on saving and mitigating these resources must be the first act of the concerned local government.

KEYWORDS: *Chanos chanos*, ~~heavy metals~~, detection, Arsenic, Cadmium, Chromium, Lead, fishpond

Comment [H1]: It has been represented by the names of metals: Arsenic, Cadmium, Chromium, Lead

I. INTRODUCTION

Thousands of living creatures are found in the aquatic environment which can benefit humans. It is a source of food and is one of the major assets that human gets from these creatures. However, many of these living creatures are killed, because of ocean pollutants. Milkfish, also called Bangus is an example of an aquatic animal. The *Chanos chanos* (Bangus) is a silvery marine food fish that is the only living member of the family Chanidae. In the Philippines, Bangus is mainly used for food because of its taste and has great demand in the market.

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Chanos chanos (Bangus) is a very healthy source of protein and is also packed with nutrients. A few of the most abundant are vitamin D, Calcium, and Phosphorus. All three nutrients are very valuable to a healthy skeletal fracture. Vitamin D that comes from the fish is essential for maintaining healthy bones because it aids in calcium absorption.

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Nowadays, due to the ocean pollution that came from a great amount of garbage and the developing industries, aquatic creatures are not safe to eat because of the heavy metals found in an organism. Although, heavy metals are naturally occurring elements that can be found in the earth's crust.Heavy metals are defined as metallic elements that have a relatively high density compared to water. With the assumption that heaviness and toxicity are interrelated, heavy metals also include metalloids, such as Arsenic whichcan induce toxicity at a low level of exposure.Heavy metals are natural components of the Earth's crust. They cannot be degraded or destroyed to a small extent they enter our bodies via food, drinking water, and air. As trace elements, some heavy metals are essential to maintain the metabolism of the human body. However, at higher concentrations, they can lead to poisoning. Heavy metals could result for instance, from drinking water contamination, high ambient air concentration near emission sources, or intake via the food chain (Banares, 2015).

Comment [H5]: Complete it with references

Comment [H6]: Use a precise definition of what is meant by heavy metals

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Arsenic is a natural metalloid element found all over Earth's crust – however when combined with other elements like hydrogen and oxygen it becomes deadly poisonous. "This chemical element is among the most toxic substances in the world and exposure may lead to various symptoms of poisoning, the development of cancer, and even death". Arsenic poisoning occurs primarily through ingestion but some of the poison also seep in through touch and inhalation (Holck and Rasmussen, 2018).

Cadmium accumulates in the kidney tissue of fishes in sub-lethal concentrations. It has been reported to possess nephrotoxic action in various animals. The kidney is also one of the principal target organs of Cadmium toxicity and exposure in almost all animal species is characterized by varying degrees of renal damage such as glomerulus, tubules, and Bowman's capsule (Kurmar *et al*., 2006; Vessey, 2010).

Chromium is present in rocks, soil, animals, and plants. It can be solid, liquid, and in the form of gas. Chromium compounds are very much persistent in water sediments. They can occur in many different states such as divalent, four-valent, five-valent, and hexavalent states. Cr VI and Cr III are the most stable forms and only their relation to human exposure is ~~are~~of high interest (Zhitkovich, 2005). Chromium VI compounds, such as calcium chromate, zinc chromate, strontium chromate, and lead chromates, are highly toxic and carcinogenic. Cr III, on the other hand, is an essential nutritional supplement for animals and humans and has an important role in glucose metabolism. The uptake of hexavalent Chromium compounds through the airways and digestive tract is faster than that of trivalent chromium compounds. Occupational sources of Chromium include protective metal coatings, metal alloys, magnetic tapes, paint pigments, rubber, cement, paper, wood preservatives, leather tanning, and metal plating (Martin and Griswold, 2009).

Lead poisoning was a classic disease and the signs that were seen in children and adults were mainly in the central nervous system and the gastrointestinal tract (Markowitz, 2000). Lead has major effects on different parts of the body. Lead distribution in the body initially depends on the blood flow into various tissues and almost 95% of lead is deposited in the form of insoluble phosphate in skeletal bones (Papanikolaou *et al*., 2005).

Even though heavy metals are naturally occurring in the earth's crust, a large number of toxic chemicals have been dumped on purpose from industrial sources or naturally flow off land and directly into our rivers and streams, which eventually end up in some fishponds.Such heavy metals are not easily excreted out because they do not break down; rather, it increases within a certain body until it reaches a high level of toxicity. These bad effects on human health like chemicals such as oil, mercury, lead, pesticides, and other heavy metals can all be found within the ponds and can contaminate water supplies and the food chain by ingesting these chemicals than the organisms.This study aimed to detect the presence of heavy metals in *Chanos chanos* (Bangus). Also, this study focused to identify what heavy metals can be found in Bangus and how harmful it is to marine food fish,and humans.

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II. **METHODOLOGY**

Samples of *Chanos chanos*were obtained in a fishpond in San Jose, Northern Samar. The sample was prepared, cleaned, and blended. The meat part and the belly part of the sample were used in this study. After which, it was mixed with 75mL of water and 25mL of the sample to make a samplesolution.

Physical Properties. The pH of the *Chanos chanos* meat extract was determined by using a digital pH meter. A 5mL of the meat extract was placed in a Beaker and a digital pH meter was dipped into the meat extract solution. After a minute, the reading of the digital pH meter was recorded. The procedure wasreplicated thrice.The water pH of the fishpondof the sampling area was also measured. It was measured using a digital pH meter. The bottles were sterilized first.The procedure wasreplicated thrice.

Comment [H9]: It's best to mention the brand &type

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Solubility. A 3mL of Bangus meat extract was placed inthree (3) test tubes separately. The first test tube was added with a 4mLHexane, the second test tube was added with 4mL water, and the third test tube with a4mL of Ethanol. Each test tube was shaken vigorously. The observations were recorded as compatible or incompatible with the different solvents used. The procedure wasreplicated thrice.

Qualitative detection of heavy metals

Qualitative detection of Arsenic. Ina prepared Bangus sample solution, a 3M HCl was added until it was barely acidic. It was centrifuged for three (3) minutes, and then the centrifugate was discarded. Then, on the residue, ten (10) drops of concentrated HCl were added, the solution was stirred and heated in a hot water bath for one minute and then the centrifugate was removed.The residue was washed with a mixture of eight drops of water and four (4) drops of concentrated HCl, and then, it was 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 three times, then four (4) drops of concentrated HNO_3were added, and heated for five (5) minutes in a water bath.After heating, 5 drops of 0.5M $AgNO_3$were added and then stirred. To clear the centrifugation, fifteen (15) drops of 2.5m NaAc solution were added.The formation of a reddish-brown precipitate indicates the presence of Arsenic (Paredero, 2017).

Qualitative detection of Cadmium. It forms a yellow precipitate with sulfide ion either from a natural solution containing free Cd^{2+} or from an ammoniacal solution of $Cd(NH_3)_4^{2+}$. Since most sulfides are insoluble, and many of them are black, the presence of other metal ions may make it difficult to detect the yellow color of CdS. Therefore, separations must be as complete as possible before testing for Cd^{2+}. In the prepared Bangus sample a 0.1 M Na_2S solution was added. The formation of yellow precipitate confirms the presence of cadmium ions (Nivalvos, 2012).

Qualitative detection of Chromium. Chromium can be taken through a series of colored tests which leaves no doubt as to its identity. Chromium (III) forms a steel green hydroxide which dissolves in excess strong base to give a deeply green-colored solution of the hydroxyl complex. Treating this complex with 3% hydrogen peroxide gives the yellow solution of the chromate ion, which upon acidification with dilute nitric acid gives the orange color of dichromate. Treatment of the cold solution of dichromate with 3% hydrogen peroxide gives the intense blue color of peroxide of chromium. This peroxide readily decomposes to the pale violet color of the original hydrated chromium (III) ion. In low concentrations of di-chromate, the blue color is fleeting, and attention must be focused on the test tube during the addition of the hydrogen peroxide to avoid missing the color change.The following color changes are all indicative of Cr^{3+}. An excess of 6M NaOH was added to about one (1) mL of the Bangus sample solution. To this solution 10 drops of 3%, H_2O_2were added. Then, the test tube was heated in the water bath until the excess $H_2O_2$was destroyed as indicated by the cessation of bubbles. The yellow solution was acidified with 3M NHO_3. The resulting orange solution was cooled in an ice bath. Finally, to the cooled solution, a drop or two of 3% H_2O_2 was added and immediate fleeting blue/steel green color was observed. This fleeting blue/steel green color indicates the presence of chromium ions (Nibalvos, 2012).

Qualitative detection of Lead. Although $PbCl_2$ is insoluble at room temperature, its solubility is increased dramatically at higher temperatures, it dissolves readily in boiling water. Pb^{2+} also forms an insoluble white sulfate, which dissolves in a solution containing acetate ion due to the formation of the weak electrolyte, Pb $(CH_3COO)_2$. The addition of chromate ion to this lead acetate solution yields a precipitate of yellow lead chromate. In the Bangus solution, a 3M HCl was added drop-wise. A large excess of HCl must be avoided because of the formation of the soluble chloro-complex, $PbCl_4^{2-}$. Centrifuged and the supernatant liquid from the white precipitate was removed.Hot water was added to the precipitate and then stirred. If the precipitate dissolves, Pb^{2+} is present. To the hot solution, 3M $H_2SO_4$was added. Centrifuged and supernatant liquid from the white precipitate ($PbSO_4$) is removed. To the precipitate, 3M NH_4 (CH_3COO) was added and then stirred. A few drops of 0.5M K_2CrO_4 were added to the solution. A yellow precipitate of $PbCrO_4$ indicates the presence of Pb^{2+} (Paradero, 2017).

III. **RESULTS AND DISCUSSION**

Comment [H11]: Add more adequate discussion to the results obtained. Compare your research results with other research results.

In this section, the data gathered in the experiment was presented. The results were based on the visible precipitate formed during the analysis. Each test was conducted thrice.

Physical Properties

The pH is one of the physical properties that can affect the presence of heavy metals in a sample. The heavy metals release rates were affected to a much greater extent in the low pH condition than in higher pH. The effect of pH on the speciation of heavy metals is of great significance to the migration and transformation of metals. The mechanism of heavy metals uptake through water may explain the influence of pH and salinity on the lethal toxicity detected (Immaculada *et al*., 2004). The change of pH conditions in the system will have a certain impact on the migration and distribution of heavy metals (Gabler, 1997). The pH of the sample if it has heavy metals contributes to its surrounding pH. Table 1 shows the pH value of the belly part and meat part of the Bangus gathered in San Jose, Northern Samar. As shown, the belly part of the Bangus concludes that it is barely acidic while the meat part is acidic. In overall, the Bangus sample is acidic in terms of the pH level. On the other hand, Table 2 shows the pH value of the water of the fishpond, the result shows that it has a neutral pH value.

Comment [H12]: List the measured pH value with the pH meter in the table.

Table 1. pH value of *Chanos chanos*

Comment [H13]: List the measured pH value with the pH meter in the table.

Sample Trial	Belly Part	Meat Part
1	Barely Acidic	Acidic
2	Barely Acidic	Acidic
3	Barely Acidic	Acidic

Table 2. pH value of the fishpond

Sample Trial	pH Value
1	7.7
2	7.2

3	7.0

The Table 3 shows the solubility of the belly part and the meat part of the Bangus. Based on the table, the belly part and meat part are soluble in the water and ~~in~~ the Methanol while both are insoluble to the Toluene. It means that the belly and meat parts of Bangus are polar molecules.

Table 3. Solubility of the *Chanos chanos*

Sample Trial	Water		Methanol		Toluene	
	Belly	Meat	Belly	Meat	Belly	Meat
1	Soluble	Soluble	Soluble	Soluble	Insoluble	Insoluble
2	Soluble	Soluble	Soluble	Soluble	Insoluble	Insoluble
3	Soluble	Soluble	Soluble	Soluble	Insoluble	Insoluble

Detection of Heavy Metals

Table 4 describes the qualitative test for Arsenic. A reddish-brown precipitate appears if there is a presence of Arsenic in the sample. In the sample, there was no formation of a reddish-brown precipitate. Hence, all samples yielded a negative result in the analysis. This shows that the Bangus from San Jose, Northern Samar were free of Arsenic contamination.

Table 4. Detection of Arsenic

Sample Trial	Belly Part	Meat Part
1	Negative	Negative
2	Negative	Negative
3	Negative	Negative

Table 5 describes the qualitative test for Cadmium. In detecting cadmium in the sample, a yellow precipitation formation confirms must appear. Based on the table, neither the belly part nor the meat parttested positive for the presence of cadmium. It simply means that the Bangus in San Jose, Northern Samar are cadmium contamination free.

Table 5. Detection of Cadmium

Sample Trial	Belly Part	Meat Part
1	Negative	Negative
2	Negative	Negative
3	Negative	Negative

Table 6 describes the qualitative test for Chromium. A visible result for chromium will be indicated by a blue/steel green color in the Bangus sample solution. It showed that the belly part and meat part of the sample tested negative for the presence of chromium. This result shows that the Bangus samples and the location of the fishpond of San Jose, Northern Samar were chromium free.

Table 6. Detection of Chromium

Sample Trial	Belly Part	Meat Part
1	Negative	Negative
2	Negative	Negative
3	Negative	Negative

Table 7 describes the qualitative test for Lead. When yellow precipitation is formed in the sample, it indicates that there is a presence of Lead.As shown in the table, the belly part of the Bangus was tested negative for the presence of the lead. Meanwhile, the meat part of the Bangus tested positive for the presence of lead. Yellow precipitation formed and appeared. It means that the Bangus in San Jose, Northern Samar have lead contamination. Lead contaminants may come from the waste thrown from the industrial factories and from the gasoline of boats that may cause contamination to the fish.

Table 8. Detection of Lead

Sample Trial	Belly Part	Meat Part
1	Negative	Positive
2	Negative	Positive
3	Negative	Positive

IV.**CONCLUSION**

Based on the data gathered, the Bangus collected from San Jose, Northern Samar were free from Arsenic, Cadmium, and Chromium. However, the belly part of the Bangus fish tested positive for the Lead content. It can be noted that such presence of heavy metals in a marine resource like *Chanos chanos* is worrisome since people living near the fishpond use these fishes as a meal. A confirmatory test should be done to know the quantity of Lead contamination in the meat extract. In the meantime, the concerned local government must act swiftly on this matter. Mitigating the problem rather than solving it is better. The local government must collaborate with institutions in helping re-exam the area for a better view of the problem.

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