Levels of Heavy Metal Concentration in the Tissue of *Crassostrea gigas* Obtained from Imo River, South Eastern Nigeria.

George, Ubong[1], Ekpo, Antai[2], Edet, Mercy[2]

[1]Department of Fisheries and Aquaculture, Institute of Oceanography University of Calabar, Calabar.
[2]Department of Marine Biology, Institute of Oceanography University of Calabar, Calabar.
talk2georgeubong@gmail.com.

Abstract: The levels of some heavy metals and total hydrocarbon (THC) in the tissues of Oysters from Imo River, Ikot Abasi in Akwa Ibom State were investigated. Samples of Oysters were collected for a period of three months in the intertidal region of the River and were analyzed using Atomic Absorption spectrophotometry for the determination of heavy metals and soxhlet extraction gravimetric method was used in the determination of total hydrocarbon. The mean level of heavy metals varied in all the three month. Also, same variation was observed for total hydrocarbon. The levels of heavy metals and total hydrocarbon during the study period across the month showed no significant difference ($P > 0.05$). This was attributed to the fact that they were less industrial activities in one month than the other resulting in the variation. These studies demonstrate that the evidence of bioaccumulation of heavy metals and total hydrocarbons were below the recommended tolerable limits when compared to that of world standards for Aquatic Organism. The result of the studies implies that Oysters caught from Imo River are safer as a food source for human consumption. However, constant monitoring of water bodies receiving effluents is emphasized in order to forestall cumulative effects of pollutants which may lead to sub-lethal consequence in future if not checked.

[George, U., Ekpo, A., Edet, M. **Levels of Heavy Metal Concentration in the Tissue of *Crassostrea gigas* Obtained from Imo River, South Eastern Nigeria.** *Academ Arena* 2015;7(7):34-37]. (ISSN 1553-992X). http://www.sciencepub.net/academia. 4

Key words: Heavy Metal, Concentration, tissue, *Crassostrea gigas*, Imo River, Nigeria.

1. Introduction

Environmental pollution is due to industrial technological revolution and speedy exploitation of every bit of natural resources. The level of progress in agriculture, industry, transportation and technology is taken as the general criterion of development of any Nation. Such activities of man have resulted in adverse effects on the survival of man himself and other living organisms in the biosphere (George *et.al*, 2014).

Despite the comparatively low level of industrial activities in developing countries in Africa, there are increasing exposures to the unwanted ecological effects of these metals because they are transported through the atmosphere and by ocean currents from sources far away from where they are produced thereby constituting pollution (Oyewo, 1998). The situation is exacerbated in coastal areas by activities such as the unloading of fertilizers, oil and fuel transportation which create spillages that directly pollute the waters, industrial effluents, mining and dredging activities (Chukwu, 2003).

The use of heavy metals in industrial and agricultural sectors is increasingly becoming a source of concern due to their harmful effects on the environment and human health. Marine environment constitutes a major pathway for exposure of living organisms to these pollutants due to the fact that growth in technology has brought about the zeal to explore and exploit natural resources, produce more food, goods and services (Oyewo, 1998). According to Oyewo (1998), the situation translates into increased industrialization which inevitably results in the release of various types and amounts of industrial wastes which are complex mixtures of several classes into the environment. When these wastes are disposed in such quantities that can cause deleterious effects to the living resources and structures whose preservation is desirable, pollution is said to take place (FAO/SIDA, 1983).

Metal contamination of aquatic ecosystems has long been recognized as a serious pollution problem. When benthic organism such as *Crassostrea gigas* are exposed to elevated levels of metals in a polluted aquatic ecosystem, they tend to take these metals up from their direct environment (Seymore 1994).

Heavy metals with preference to cadmium, lead, copper and specifically mercury are potentially harmful to most organisms even in very minute concentrations and have the tendency to accumulate through the aquatic food chain with severe risk to both aquatic organisms and humans. This study was carried out to ascertain the levels of heavy metal in the tissues of oysters (*Crassostrea gigas)* obtained from Imo River.

2.0 Materials And Method

Study Area

The study area (Imo River) is one among the essential rivers in the Niger Delta, It is situated South-East of Nigeria. The river originate from the Imo State (hill region) and flows down passing many cities, farmland and empties into the Atlantic Ocean. The river is located between Latitude 4°53'4.47" and Longitude 7°10'24.97". The river is always flooded, especially during the rainy period (wet season; April to November). The river bank is well sheltered with mangroves and grasses. Industrial activities are also predominant (e.g. Afam Power Station and Shell Development Petroleum Company) add with illegal petroleum refineries and bunkering activities. The River is the source of drinking water and livelihood of the people. The major occupation is fishing and farming.

Collection of specimen

Samples of *Crassostrea gigas* were collected on a monthly basis for three months (August – October, 2014) at UAC beach (along Imo River) from the landings of the artisanal fishermen.

Preparation of sample

The study was carried out at pure and applied chemistry laboratory, University of Calabar, Calabar, Cross River State. *Crassostrea gigas* samples which consisted specimen of uniform size, were collected and used for the studies. The samples Collected from the landings of artisanal fishermen were prepared and the composite was obtained prior to determination of heavy metals. The tissues were carefully excised after rinsing with double distilled water and oven dried at 110^0C. The heavy metal contaminations in the dried samples were estimated after acid digestion, following the standard method of AOAC (2000) using Atomic Absorption Spectrophotometer GF 3000. The results were express in mg/l metal per dry weight.

Statistical analysis

Analysis of variance (ANOVA) was used to test for significant different in the levels of heavy metal in the tissue of the test organism during the different month of sampling.

3.0 Results

3.1 Heavy metal concentration in the tissue of *Crassostrea gigas* obtained from Imo River (August-October, 2014).

The concentration of heavy metal in the tissue of *Crassostrea gigas* was in the order Pb > Fe > Zn > Cr > Cu > Cd and Hg which was not detected throughout the studied period. The mean and standard deviation of the heavy metals in the tissues varied across the different sampling months (Table 1). The mean concentration of Cadmium was relatively low ranging from 0.029 – 0.042 mg /l. The highest Cd mean concentration (0.042 mg/l) was in October and least in September (0.029 mg/l). The mean concentration of Cr ranged from 0.055 – 0.069 mg/l. This was highest in August (0.069 mg/l) and least in September (0.055 mg/l). The mean concentration of Cu ranged from 0.043 – 0.054 mg/l. The highest mean concentration of Cu (0.054 mg/l) was recorded in October and least in August with a value of (0.043 mg/l). The mean concentration of Fe ranged from 0.124 – 0.147 mg/l. highest value of (0.147 mg/l) was recorded in August and least value of (0.124 mg/l) in September. The mean concentration of Zn ranged from 0.124 – 0.146 mg/l. Mean Zn concentration was highest (0.146 mg/l) in the month of August and the least value of (0.124 mg/l) was recorded in the month of October. The mean concentration of Pb had a uniform value of 0.31mg/l recorded for both September and October. Pb was not detected in the tissue of the test organism during the first month of sampling. Throughout the studied duration Hg was not detected in the tissue of *Crassostrea gigas*. The mean concentration of THC ranged from 0.081 – 0.085 mg/l. The highest value of (0.085 mg/l) recorded in October and least value of (0.081 mg/l) in August (Table 1, Fig 1). Statistical analysis showed that there was no significant difference in any of the heavy metal across the different sampling months.

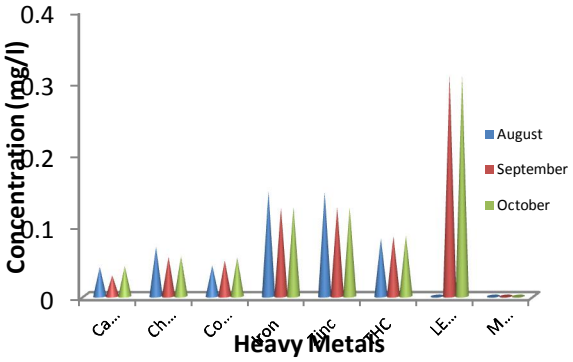

Fig 1: Mean variation in the Concentration of heavy metal and Total hydrocarbon in the tissue of *Crassostrea gigas* obtained from Imo River (August-October, 2014).

Table 1: Mean Concentration of heavy metal and Total hydrocarbon in the tissue of *Crassostrea gigas* obtained from Imo River (August- October, 2014).

Parameter	August (mg/l)	September (mg/l)	October (mg/l)
Cadmium	0.041± 0.002	0.029 ± 0.001	0.042 ± 0.001
Chromium	0.069 ± 0.002	0.055 ± 0.001	0.056 ± 0.000
Copper	0.043 ± 0.05	0.050 ± 0.002	0.054 ± 0.001
Iron	0.147 ± 0.000	0.124 ± 0.000	0.125 ± 0.001
Zinc	0.146 ± 0.001	0.125 ± 0.001	0.124 ± 0.001
THC	0.081 ± 0.001	0.084 ± 0.001	0.085 ± 0.001
LEAD	ND	0.31 ± 0.23	0.31 ± 0.015
Mercury	ND	ND	ND

*ND - Not Detected

4.0 Discussion

The concentration of heavy metals; (Cadmium, Iron, Zinc, Chromium, Copper, Lead, Cadmium and Total hydrocarbon) in the tissue of *Crassostrea gigas* obtained from Imo River indicates a low level of metal pollution. This may be attributed to the low human activities, with regards to discharge of untreated sewage and uses of industrial materials that contain metals or the inability of the organism to assimilate these metals. The presence of these elements in the tissues of *Crassostrea gigas* in the study period agrees with reports elsewhere (Jack *et.al*., 2013; Eja *et.al*., 2003; Kotze *et.al*., 1999 and Moriarty *et.al*., 1984). Except for Cadmium (Cd), the concentrations of other metals were higher in the tissues of *Crassostrea gigas*.

The mean concentration of heavy metals (Cadmium, Iron, Zinc, Chromium, Copper, Lead, Cadmium) and THC in the tissues of *Crassostrea gigas* in all the three months did not exceed acceptable limits when compared with world standards for Aquatic Organism. The values observed in this study were also lower than those reported in previous study which was suggestive of sub-lethal toxicity in humans (Ayenimo, *et.al*., 2005 and USEPA, 1986).

The possible explanation and mechanism to this present result is not yet known. However, according to Arellano *et al* (1999), the differences in the pattern of heavy metals distribution might be a result of the differences in feeding habits, habitats, ecological needs and metabolism of the fish. The chemical behavior of a metal is primarily governed by its retention and released reaction. Increase in pH results in increased adsorption of some metals in tissues of organism and sediments. Metal adsorption also depends on the presence and type of sediments and organic matter. However, the distribution, accumulation, bioavailability, biodegradability and toxicity of metals depend not only on their concentrations, but also on their physicochemical association with the surrounding system.

The result of this study show imminent problems of contamination in Imo River associated with heavy metal, if measures are not put in place to contained pollution in the system. This emphasizes the need for regular monitoring of Rivers and other aquatic system receiving effluents from industrial discharge in order to prevent the effects of pollution in the River which may lead to sub-lethal consequence in the ecosystem affecting both aquatic flora and fauna, finally may result in food poisoning to man which is the consumer of these Organisms.

5.0 Conclusion

Crassostrea gigas have the tendency to bio-accumulate with preference for some heavy metals depending on the ecological area. This could further demonstrate that the organism possesses bio-indicator attribute for monitoring metals in aquatic system. Aquatic organism absorbs metal through the nature of their habitat, ingestion of food and water contaminated with heavy metal. The concentrations of heavy metal in the present study did not exceed the maximum allowable level contained in WHO and USEPA regulations. Although, could be detrimental to the health of human beings and aquatic life if safety measures are not put in place. It is recommended however that the multinationals in these areas, should take notice of their acts and ensure improved waste management and monitoring polices.

Corresponding Author:
Mr. Ubong George
Department of Zoology & Env. Biology,
University of Calabar,
P.M.B 1115, Calabar.
E-mail: **talk2georgeubong@gmail.com.**

References

1. Arellano, J.M, Ortiz, J.B Capeta dasilva, D. Gonzalez de Canales, M.L; Surasquete , C and Blasco, J. Levels of copper, Zinc, manages and iron in two fish species from salt marshes of Cadiz Bay (South west Ibrians Peniosula) *Bal. Inst. Esp. ocenogr*., 1999:31 (1): 485- 488.
2. Association of Official Analytical Chemist. Official method of analysis, 15th Edn. Washington DC, 2000.
3. Ayenimo, J.G., C. A. Adeyinwo, I. A. Amoo and F. I. Odukudu (2005). A preliminary investigation of heavy metals in periwinkles from Warri River, Nigeria. Journal of Applied Science, 2005:*5*(5): 813 - 815.
4. Chukwu, L. O., and Nwankwo, D.I. The impact of land based pollution on the hydrochemistry and macrobenthic community of a tropical West African Creek. Bruen, *M. (Ed.) Diffuse Pollution and Basin Management Proceedings of the 7th* International Specialised IWA Conference, Dublin Ireland, 2003: **4:** 66-72.
5. Eja, M.E., O. R. Ogri and G. E. Arikpo. Bio-concentration of heavy metals in surface sediments from the Great Kwa River Estuary, Calabar, South Eastern Nigeria. Nigerian Journal of Environmental Sociology, 2003: 2:247-256.
6. George, Ubong Uwem, Joseph Asor, Andy, John A. Histopathological Alterations In Gills Of Fingerlings Of Clarias Gariepinus (Burchell, 1822) Following Sublethal Acute Exposure To Hevea Brasiliensis. International Journal of Scientific & Technology Research, 2014:3(9): 252-255.
7. Jack, I.R., J. K. Fekarurhoho., F. U. lgwe and K. korosaye- Orubite. Determination of total hydrocarbon levels in some marine organisms from some towns within the Rivers State of Nigeria. Journal of Applied Sciences and Environmental Management, 2005:9(3): 59-61.
8. Kotze, P. Du., Preez, H. H. and J. H. J. Van Vuren. Bio-accumulation of copper and zinc in *Oreochromis mossambicus* and *Clarias gariepinus* from the Olitants River, Mpumalanga, South Africa. Water S.A, 1999:25 (1):99-110.
9. Moriarty, F., H. M. Hanson and P. Treestone. Limitation of body burden as an index of environmental contamination heavy metal in fish *Cottus gobio* from the River Ecclesbourne, Derbyshire, Environmental Pollution Service, 1984:34:297-320.
10. Seymore T. Bioaccumulation of metals in *Barbus marequensis* from the Olifants River, Kruger National Park, and lethal levels of Mn to juvenile *Oreochromis mossambicus*. 1994; MSc thesis, Rand Afrikaans University, South Africa.
11. United States Environmental Protection Agency (USEPA) (1986). Biological indicators of watershed health. Available at *http://www.epa.gov/* Last modified January, 1987.

7/17/2015