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HEAVY METAL CONCENTRATIONS IN DIFFERENT BODY PART OF CRAB, BARYTELPHUSA *GUERINI* FROM GODAVARI RIVER

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ABSTRACT

The concentration of heavy metals Arsenic (As) and Chromium (Cr) in hepatopancreas, gills, muscle and whole body of crab, Barytelphusa guerini was carried out during different seasons summer, monsoon and winter in order to ascertain the pollution status of the river. The results showed varying levels of accumulation of Arsenic and Chromium in the crab. The level of As in muscle, gills, hepatopancreas and whole body in summer, monsoon and winter seasons was found that higher than the recommended maximum allowable standards in food. Where as Cr level in muscle and gills in summer seasons, hepatopancreas and whole body in monsoon and muscle and whole body in winter season were higher than the recommended maximum allowable standards in food. The level of Cr in muscle (monsoon), gills (monsoon and winter), hepatopancreas (summer and winter) and whole body (summer) were lower than the standards. The results suggest that the Godavari river system is contaminated with heavy metals.

INTRODUCTION

Bio-concentration is the net accumulation of a substance from water into an aquatic organism resulting from the simultaneous uptake and elimination of the substance. Fish, crab, bivalve molluscs etc are used in bioaccumulation tests because they are higher tropic level organisms and are usually eaten by man. Tissues such as liver, kidney, muscle, viscera and whole organisms are analysed to determine the concentration of the metals Dublin-Green (1994). In an attempt to define and measure the effects of presence of pollutant on aquatic system, biomarkers have attracted a great deal of interest. The principle behind the biomarker approach is the analysis of organisms for their metal contents in order to monitor the excess metals in their tissues. The various aquatic organisms living in rivers, lakes and sea are potentially useful as bio-marker of metals pollution, they include fish, shellfish, oyster, crabs, mussels, clams, aquatic animals and plants Khallaf *et al.* (1994), Magliette *et al.* (1995) and Stewart *et al.* (1997).

Increase in metal concentration from different sources is a result of increasing metal pollution in the rivers and its accumulation in aquatic organisms and their edible tissues. Many workers demonstrate that metal concentrations in aquatic organisms are higher than in water, which indicates the bioaccumulation. They studied on the transfer of metals through the trophic food chain Kalfakakon *et al.* (2000), Subrahmanyam *et al.* (2001) and Gary (2002).
Crabs is important food item and source of protein to man. Since there is no formal control of effluent discharge from industries and homes into the river, it is important to monitor the levels of metals in the reservoir in comparison. The concentration of Arsenic and Chromium were measured in the gills, muscle, hepatopancreas, and whole body of crabs in order to assess the food consumption safety. It could also establish a baseline for future studies of heavy metal pollution.

MATERIALS AND METHODS

Healthy uniform size adult crabs, *Barytelphusa guerini* were collected from the Godavari river near Aurangabad. The crabs were collected every season for a period of one year from February-2005 to January-2006.The crabs were brought to the laboratory and placed in fresh river water for few hours to remove mud. Hepatopancreas, Gills and Muscle were dissected out from these crabs. These tissues separated from crabs were taken into petridishes and kept in a hot air oven maintained at 60^0C for a period of 48 –72 hours. The heavy metals concentrations were analyzed from these tissues and whole body. Heavy metal like Arsenic and Chromium were estimated by using standard methods as described by APHA (1998).

Digestion of Crab Tissues

The samples were digested in open beakers on a hot plate. 0. 5 gm of each organ was weighed out in an open beaker and allowed to digest by adding nitric acid and perchloric acid in (4:1) ratio. Kept on hot plate and the temperature gradually allowed to rise to 60^o C continue adding both acids in (4:1)

ratio till the sample become colourless. The digested sample were allowed to cool and transferred to 25 ml volumetric flasks and made up to mark with de-ionised water. The digests were kept in plastic bottles and later the heavy metal concentrations was determined using an atomic absorption spectrophotometer (AAS). The actual concentration of each metal was calculated using the formula:

$$\text{Actual concentration of metal in Sample (ppm)} = \frac{\text{Reading of digest}}{\text{Weight of sample digested}} \times \text{Dilution factor}$$

RESULTS AND DISCUSSION

The estimation of heavy metal in different tissue like muscle, gills, hepatopancreas and whole body of crab, *Barytelphusa guerini* was carried out different seasons summer, monsoon and winter in a year. The samples were analysed

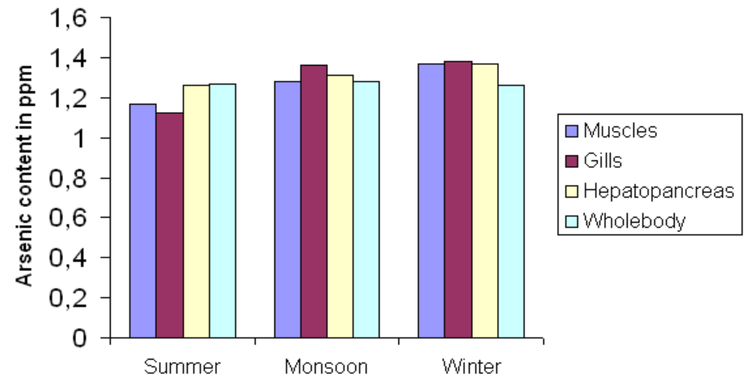

Fig. 1 Frequency histogram showing arsenic content (ppm) in different tissue of *Barytelphusa guerini*

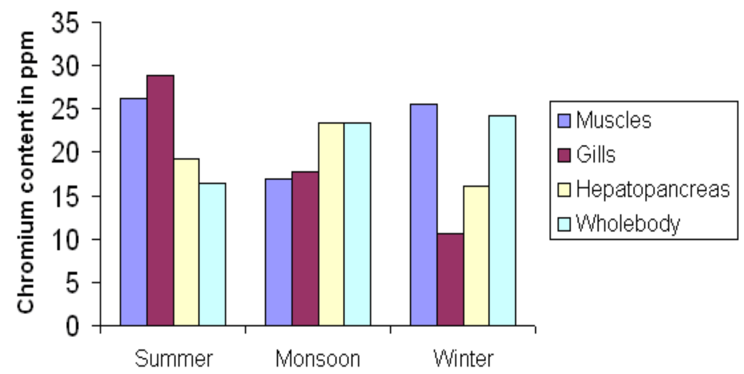

Fig. 2 Frequency histogram showing chromium content (ppm) in different tissue of *Barytelphusa guerini*

Table 1

Seasonal variation in average arsenic content (ppm) in different tissues of *barytelphusa guerini*

Seasons	Muscles	Gills	Hepatopancreas	Whole body
Summer	1.17	1.12	1.26	1.27
Monsoon	1.28	1.36	1.31	1.28
Winter	1.37	1.38	1.37	1.26

Table 2

Seasonal variation in average chromium content (ppm) in different tissues of *barytelphusa guerini*

Seasons	Muscles	Gills	Hepatopancreas	Whole body
Summer	26.25	28.80	19.25	16.50
Monsoon	17.00	17.83	23.33	23.33
Winter	25.50	10.62	16.12	24.20

and contents of heavy metals were detected in order to know the concentration of these metals in crab tissues. The results are given in Table 1& 2 and illustrated in Figure (1 and 2).

In the present investigation it was found that Arsenic (As) in muscle it varied from 1.37 ppm in winter to 1.17 ppm in summer. In gills it varied from 1.38 ppm in winter to 1.12 ppm in summer. In hepatopancreas it varied from 1.37 ppm in winter to 1.31 ppm in monsoon. In whole body it varied from 1.28 ppm in monsoon to 1.26 ppm in winter. From all the tissue, maximum concentration i.e. 1.38 ppm of arsenic was recorded in gills in winter. However minimum concentration was observed i.e. 1.12 ppm in gills in summer. In all the tissues arsenic content in crab sample from Godavari river exceeded from Indian standard limit of 1.1 mg/kg in food Awashthi (2000).

Arsenic biogeochemical cycle occurs mostly in the aquatic environment and its bioaccumulation is an important ecotoxicological aspects. Inorganic arsenic produce acute, sub acute and chronic toxic effects, which may be either local or system. Acute toxic effects include abdominal cramping, hypersthesia in extremities, abdominal patellar reflexes and abdominal electrocardiograms. Other effects of arsenic include peripheral vascular disturbances resulting in gangrene and a disease termed Black foots disease Rajesh and Agrawal (2005). In the present study it was found that Chromium (Cr) in muscle it varied from 26.25 ppm in summer to 17.00 ppm in monsoon. In gills it varied from 28.75 ppm in summer to 10.62 ppm in winter. In hepatopancreas it varied from 23.33 ppm in monsoon to 16.12 ppm in winter. In whole body it varied from 24.20 ppm in winter to 16.50 ppm in summer. From all the tissue, maximum concentration i.e. 28.75ppm of chromium was recorded in gills in summer. However minimum concentration was observed i.e. 10.62 ppm in gills in winter.

Chromium (Cr) level in muscle and gills in summer seasons, hepatopancreas and whole body in monsoon and muscle and whole body in winter season were higher than the recommended maximum allowable standards in food. The level of Cr in muscle (monsoon), gills (monsoon and winter), hepatopancreas (summer and winter) and whole body (summer) were lower than the Indian standard limit of 20.00 mg/kg.

Obasohan *et al.* (2006) studied the heavy metals concentrations in two tropical fish species, *Malapterurus electricus* and *Chrysichthus nigrodigitarus* from Ogba river in Benin city, Nigeria. It was found that the level chromium in both fishes were higher than the world health origination (WHO) recommended maximum allowable standards in food fish.

The harmful effects of chromium to human are mostly associated with its hexavalent form. Chromium toxicity includes liver necrosis, nephrites and gastrointestinal irritation Athar and vohora (1995).

Therefore, special attention should be given to the water quality and bioaccumulation of metals (arsenic and chromium) in crab, *Barytelphusa guerini*. In present investigation it was found that the level of arsenic and chromium in some tissues crab, *Barytelphusa guerini* were higher than the recommended maximum allowable standards in food. These results suggested that the Godavari river system was contaminated with heavy metals and the consumption of crab of the river could pose heath hazards to man. It is also suggested that *Barytelphusa guerini* may be useful as a potential indicator of metal pollution, but it should be remembered that there is no certainty that the metal concentration in the environment will be accurately reflected in the tissue of the crab, for there exists a degree of regulation and elimination of metal in the body of *Barytelphusa guerini.*

REFERENCES

APHA, 1998. *Standard Method for Examination of Water Wastewatcr,* 18th Edition, American Public Health Association, AWWA,WPCF. (eds) Washington D.C. pp. 1268.

Athar, M. and Vohora, S.B. 1995. Heavy metals and environment. In : *Man and Environment Series* (Ed. P.K.Ray) Wiley Easton Ltd. New Delhi, pp. 1-195.

Awashthi, S.K. 2000. *Prevention of Food Adulteration Act No. 37 of 1954 Central and State Rules as Amended for 1999,* 3rd edition. Ashoka Law House, New Delhi.

Dublin-Green, W.F., Nwankwo. J.N. and Irechukwu, D.O. 1998. Effective regulation and management of HSE Issues in the Petroleum Industry in Nigeria. *SPE International Conference on Health Safety and Environ. In oil and Gas Exploration and Production*, Caracas, Veneeuela, 7-10.

Gary, J.S. 2002. Biomagnifications of methyl mercury in marine systems the perspective of and ecologist Mar. *Pollut. Bull*. 45 : 46 – 52.

Kalfakakon, V. and Akrida-Demertzi, K. 2000. Transfer factors of heavy metals in aquatic organisms of different trophic level. ttp.//business.nol.gr/boil/allfile/HTML/Kalfakhtm.

Khallaf, M.F., Neverty, F.G. and Tonkhy, T.R. 1994. Heavy metal concentration in fish and water of the river Nile and Fish farms In: *National Conference on the River Nile*, Assiut. Univ., Egypt.

Magliette, R.J., Doherty, F.G., Mackinney, D.V. and Venkataramani, L. 1995. Need for environment quality guidelines based on ambient freshwater quality criteria in natural water case study zinc. *Bull. Environ. Contam. Toxico*. 54 : 532-626.

Obasohan, J., Oronsaye and Obano, E.E. 2006. Heavy metal concentration in *Malapter-*

urus electricus and *Chrysichthys nigrodigitatus* from Ogba river in Benin city, Nigeria. *African J. of Biotechnology.* 5 (10) : 974-982.

Rajesh Kumar and Madhoolika Agrawal, 2005. Biological effects of heavy metals: An overview. *J. Environ. Bio*. 26 (2) : 301-313.

Stewarf, F.M., Monteiro, I.R. and Furness, R.W. 1997. Heavy metal concentration in Cory's shearwater.

Subrahmanyam, M.N. and Al-Mohanna, S.Y. 2001. Flux of heavy metals accumulation in various organs of the intertidal marine blue crab, Portunus pelagicus (L) from the Kuwait coast after the Gulf W.