*Biosciences, Biotechnology Research Asia* Vol. **5**(2), 829-832 (2008)

# Relationship of lead 210 in activity and different feeding habit of fresh water fishes in River Kaveri, Tiruchirappalli, Tamil Nadu

**B. AMANULLAH, M. RAJU and GEEVARGHESE MATHEW**

P.G. & Research Department of Zoology, Jamal Mohamed College (Autonomous), Tiruchirappalli - 620 020 (India).

(Received: October 28, 2008; Accepted: November 23, 2008)

**ABSTRACT**

Concentration of $^{210}$Po was determined in the muscle and bone of 15 species of fishes collected from river kaveri. The concentration of $^{210}$Pb was ranged between 0.47 Bq/Kg and 2.9 Bq/Kg and in muscle between 2.5 Bq/Kg and 8.4 Bq/Kg in bone. The $^{210}$Pb concentration recorded maximum in muscle of carnivorous fish *Hetcropheastes fossilis* (2.9 Bq/Kg) and minimum in the *Cirrhinus mrigal* (0.47 Bq/Kg) Similarly $^{210}$Pb was found maximum in bones of carnivorous fishes *Glossogobius giuris* (8.4 Bq/Kg).

**Key words:** Polonium - 210, Lead - 210, carnivorous fishes.

## INTRODUCTION

The occurrence of $^{210}$Pb in the environment have been recognized for more than fifty years. Since it was also an ubiquitous components of the natural[1] radiation environment and hence it is present in almost all biotic component leading to direct and indirect human radiation exposure[11]. The $^{210}$Pb is component strongly accumulated by organisms and transferred via food along a tropic chain[1].

It is generally known that marine organisms are capable of concentrating toxic elements including radionuclides with in their tissues although the concentration of levels of the individual element or radionuclide in water may be exceedingly small. Excellent reviews on the distribution and accumulation pattern of aquatic organisms with respective radioelements following waste discharge from nuclear utilize and weapon tests fallout are available[8].

A plenty of research work has been done through out the world by many scientists with reference to distribution and accumulation of radioactive elements in marine ecosystem[12]. Marine biota have been found to contain high concentration of $^{210}$Pb and $^{210}$Po which are considered to be the major source to radiation dose to human beings[3].

Investigation on distribution, bioaccumulation of man-made radio nuclides are intensively carried out in the vicinity of nuclear power stations, reactor, research centres and in relation to nuclear weapon test. Also levels of natural radioactivity in marine environment extensively studied in Mangalore Coast[10] and in Gulf of mannar[4]. But their limited study has made in the fresh water system. Hence, in the present investigation is made to assess the level of radio nuclide $^{210}$Pb in the fishes based on their feeding habits.

## MATERIAL AND METHODS

### Collection of samples

Fresh water fishes such as *Catla catla, Labeo rohita, Labeo fimbriatus, Labe boga, Cirrhinus mrigal, Cirrhinus cirrhosa Oreochromis*

*mossambicus, Punitus sarana sarana, Mystus vittatus, Clarius bactrachus, Glossogobius giuris is giuris, Channa orientalis, C. striatus, C. punctatus, Heteropneustes fossilis* were collected from Grount Anicut, Tricuchirapalli.

**Determination of $^{210}$Pb**

$^{210}$Pb is estimated by its daughter $^{210}$Po after a certain storage period. The method consists of an initial plating of $^{210}$Po from the sample solution which is repeated to ensure that the solution is essentially free any residual $^{210}$Po. Now the solution is set aside for a period of three months to allow ingrowth of $^{210}$Po in accordance with the following.

$$^{210}\text{Pb} \xrightarrow{22.3\,(\text{year})} {}^{210}\text{Bi} \xrightarrow{(5\,\text{Days})} {}^{210}\text{Po} \quad (138.4\ \text{days})$$

After 3 month the same solution containing in growth $^{210}$Po was again replated in a brightly polished silver planchette and the activity was counted in an alpha counter.

$$(\text{cpm} + \text{SD}) \times \frac{100}{\text{E}} \times \frac{1}{60} \times \frac{1}{\text{W}} \times \frac{1}{e^{-\lambda 1}} = \text{Bq/Kg (dry)}$$

Where,

$$\text{CPM} = \frac{(\text{S+B counts})}{\text{Time (min)}} - \frac{\text{B counts}}{\text{Time (min)}}$$

SD = Standard Deviation
E = Efficiency of counter
60 = To convert to DPS (Bq)
W = Dry weight of sample taken in gram
$e^{-\lambda 1}$ = Delay time in counting

**Nuclear instruments used**

For the present investigation alpha counter with Zns (Hg) as detector is used for the estimation of alpha activities of samples

**Alpha counting system**

The alpha counting system employs a scintillation principles of detection, using Zns (Ag) Powder as the phosphor, which was uniformly applied on one face of the clear circular Perspex disk of 2mm thick and 5cm diameter. The uncoated surface of the disk was optically coupled to a 5cm diameter photomultiplier. The whole counting detector assembly (ECIL RCS 4027 A) was housed

**Table 1: $^{210}$Pb activity in chosen fresh water fishes of Tiruchirappali**

| S. No | Name of fishes | | $^{210}$Pb activity (Bq/Kg) |
|---|---|---|---|
| | **Herbivorus** | | |
| 1. | *Catla catla* | | |
| | | Muscle | 0.6±0.3 |
| | | Bone | 4.9±1.0 |
| 2. | *Labeo rohita* | | |
| | | Muscle | 2.6±0.5 |
| | | Bone | 6.7±1.1 |
| 3. | Labeo firmbriatus | | |
| | | Muscle | 1.3±0.3 |
| | | Bone | 4.3±0.9 |
| 4. | Labeo boga | | |
| | | Muscle | 1.6±0.7 |
| | | Bone | 3.4±.16 |
| 5. | *Cirhinus mrigal* | | |
| | | Muscle | 1.0±0.6 |
| | | Bone | 5.3±1.8 |
| 6. | *Cirhinus cirrhosa* | | |
| | | Muscle | 0.7±0.47 |
| | | Bone | 3.0±1.1 |
| | **Omnivorous** | | |
| 7. | *Oreochiromis mossambicus* | | |
| | | Muscle | 0.56±0.7 |
| | | Bone | 3.8±0.9 |
| 8. | Punitus sarana sarana | | |
| | | Muscle | 1.19±0.63 |
| | | Bone | 5.5±2.05 |
| | Carnivorous | | |
| 9. | *Mystus vilatus* | | |
| | | Muscle | 1.7±0.5 |
| | | Bone | 4.4±1.0 |
| 10. | *Clarius bactrachus* | | |
| | | Muscle | 0.5±0.3 |
| | | Bone | 2.5±0.8 |
| 11. | *Glossogabius giuris giuris* | | |
| | | Muscle | 1.3±0.6 |
| | | Bone | 8.4±2.11 |
| 12. | *Channa orientalis* | | |
| | | Muscle | 0.8±0.4 |
| | | Bone | 1.9±0.8 |
| 13. | *Channa striatus* | | |
| | | Muscle | 0.8±0.2 |
| | | Bone | 1.9±0.8 |
| 14. | *Channa punctatus* | | |
| | | Muscle | 2.1±0.6 |
| | | Bone | 5.1±0.6 |
| 15. | *Heteropneustes fossilis* | | |
| | | Muscle | 2.9±0.7 |
| | | Bone | 4.3±1.2 |

in a mild steel housing provided with a sliding type sample loading arrangement. The ancillary electrons consists of a scalar, timer, pulse amplifier and E.H.T unit, all integrated to from a compact desktop unit with a $^{239}$Po alpha standard source (5.15 Mev), counting efficiency of the order of 22%-28% was obtained, while background count rate was in the range of 0.05 to 0.2 cpm. The radionuclides of biological sample were determined based on the method of Kamath *et al* (1964)[6].

## RESULTS

The $^{210}$Pb concentration in the muscle and bone of chosen fishes of the Triuchirappalli are present in Table 1. Investigation of $^{210}$Pb accumulation by fish has shown the following ascending order *Cirrhinis mirigal* (muscle : 1.0 Bq/Kg; bone : 5.3 Bq/Kg) *Clarius bactrachus* (muscle 0.5 Bq/Kg; bone : 2.5 Bq/Kg;) < *Oreochromis mossambicus* (muscle: 0.56 Bq/Kg; bone 3.8 Bq/Kg)< *Catla catla* (muscle: 0.6 Bq/Kg; bone : 4.9 Bq/Kg;)< *Cirrhinus cirrhosa* (muscle: 0.7 Bq/Kg; bone : 3.0 Bq/Kg) *Channa straitus* (muscle : 0.8 Bq/Kg; bone : 2.9 Bq/Kg;) < *Channa orientalis* (muscle: 0.8 Bq/Kg; bone : 1.9 Bq/Kg)< *Cirrhinis mirigal* (muscle: 1.0 Bq/Kg; bone 5.3 Bq/Kg) < *Puntius sarana sarana* (muscle: 1.19 Bq/Kg; bone : 5.5 Bq/Kg) < *Labeo fimbriatus* (muscle : 1.3 Bq/Kg; bone: 8.4 Bq/Kg) < *Labeo boga* (muscle : 1.6 Bq/Kg; bone 3.4 Bq/Kg) < *Mystus vittatus* (muscle : 1.7 Bq/Kg; bone : 4.4 Bq/Kg) < *Channa punctatus* (muscle: 2.1 Bq/Kg; bone : 5.1 Bq/Kg) < *Labeo rohita* (muscle : 2.6 Bq/Kg; bone : 6.7 Bq/Kg) < *Heterophcutes fossilis* (muscle: 2.9 Bq/Kg; bone : 4.3 Bq/Kg). Among the above fish species analysed the $^{210}$Pb concentration recorded maximum in muscle of carnivorous fishes *Heteropneustes fossilis* (2.9 Bg/Kg) and minimum concentration recorded in the *Cirrhinis mirigal* (0.47 Bq/Kg). In the case of bone maximum concentration registered in the fish of *Glossogobius giuris giuris* (8.4 Bq/Kg).

### $^{210}$Pb activity in fishes based on their feeding habits

In the present investigation shows that the $^{210}$Pb accumulation was found higher in the acrnivore fishes than the herbivore fishes. Among the herbivorous fishes the $^{210}$Pb activity was recorded in *Lebeo rohita* (2.6 Bq/Kg) and Labeo boga (1.6 Bq/Kg). In the case of carnivorous fishes the higher $^{210}$Pb activity was found higher in the *Heteropneustes fossilis* (2.9 Bq/Kg), and followed by *Channa punctatus* (2.1 Bq/Kg) and *Mystus vittatus* (1.7 Bq/Kg).

## DISCUSSION

Analysis of $^{210}$Pb accumulation in fish indicate that the accumulations are higher in bones than in muscle. The $^{210}$Pb concentration in fishes of the present study are 0.5-2.9 Bq/Kg for muscle and 1.9-8.4 Bq/Kg for exoskeleton. The higher concentration in the muscle of fish are higher than those reported by Holtzmen (1966)[5] in fish (0.01 Bq/Kg) from Great Lakes of Alaska. Direct absorption of radioisotope with the gill membrane could be the reason for this higher activity. In addition, the benetic mode of life and carnivorous feeding could also be attributed for this higher activity. Since ingestion is the dominant means by which radioactive materials are accumulated in aquatic organisms. Very few published data are available for $^{210}$Pb accumulations in fresh water biota, radioactive materials present in water may be taken up by the aquatic organisms by adsorption. Absorption and engulfment of food which contain the nuclides[4], and the incorporation of ions into physiologically important system[7]. Variation in incorporation or dadio nuclides is mainly due to different feeding habits[1].

## REFERENCES

1. Almasrim, M.S., Manish, S., Budier, Y., Nashwati, A., $^{210}$Po and $^{210}$Pb concentration in fish consumed in Syria. *J of Envrionment Radioactivity,* **49**: 345-352 (2000).

2. Cherry, R.D. and Heyraud, M., The polonium - 210 content of marine shrimp. Variaion with biological and envrionmental factors. *Mar. Biol*. **65**: 165-75 (1981).

3. Cherry, R.D, Heyraud M and Rindfun R. $^{210}$Po teleost fish and in marine mannals: Inter family difference and possible association between $^{210}$Po and red muscle content. *J. of Envrio. Radioactivity,* **24**: 273-291 (1994).
4. Hameed PS, and Somasundaram, S.S.N., A survey of Bivalve mollusks in gulf of Mannar, India, *India Journal of Fisheries* **45**(2): 177-181 (1998).
5. Holtzmen RB, Natural levels of lead - 210 polonium - 210 and Radium - 226 in human and biota of the Arctic. *Nature*. 210 (1094-1097)
6. Kamath, PR, Bhar IS, Kamala Rudran, Iyenger MAR, Koshy E, Waingankar VS, and Khanolkar VS. Recent radiochemical procedure for bioassay studies at Tromby. *Proceedings of symbosium on assessment of Radioactivity in man, Heidelbeg, IAEA, Vienna,* 195-215 (1964).
7. Lehniger, A.L., Role of metal ions in enzyme systems. *Physiol. Rev.,* **30**: 393-429 (1950).
8. Pentreath, R.J., General Review of literature relevant to costal water discharge. In Behavior or Radionuclides Released in Costal Water. *IAEA-TECODOC-329, IAEA, Vienna*, 17-66 (1985).
9. Pillai, K.C., Heavy metals in aquatic envrionment in C.K. Varshney (e.d.), Water pollution and Management, Wiley Estern Limitted New Delhi, 75-93 (1985).
10. Radhakrishna AP, Somashekarappa HM, Narayana Y. and Siddappa K. Anew natural radiation backgrount on the South West Cost of India. *Health Phys*, **65**(5): 390-395 (1993).
11. Rajashekara, K.M., Narayana Y, Karunakara N and Siddappa K. distribution of $^{210}$Po in Riverin envrionment of coastal Karnataka. *Envrionmetal Geochemistry*, **1-2**: 321-323.
12. Yamamoto M, Abe T, Kuwabara J, Komura K and Takiza Y. Polonium - 210 and Lead - 210 in marine organism intake level for japanese. *J. of Radio analytical Nuclear Chem.,* **178**: 81-90 (1994).