IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 8, Issue 12 Ver. I (Dec. 2014), PP 01-03
www.iosrjournals.org

Analysis of Radioactivity Content in Sediment, Water and Fish Collected From Rajakkamangalam Estury of Kanyakumari District in Tamilnadu, India

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Abstract: *The natural radioactivity due to Uranium, Thorium and Potassium in soil, and water contributes to the radiation dose received by human beings significantly. For assessing the environmental radiological impact to the public it is essential to evaluate the activity levels of these nuclides. Results of the gamma ray spectrometric measurements, carried out for natural radioactivity levels due to* ^{226}Ra, ^{226}Th, ^{40}K, *and alpha, beta activity levels in sediment, water and fish collected from Rajakkamangalamestury were determined. The alpha and beta activities are found to be greater in sediment with 114.764 Bq/kg and 357.25 Bq/kg respectively. The* ^{40}K *potassium content is found to be higher in fish with 73.81 Bq/kg than in sediment and water. The results of these investigations are discussed detail in this paper.*
Keywords:*Radioactive nuclides, sediment, water, fish*

I. Introduction

Exposure to ionizing radiation from natural sources is a continuous and unavoidable feature to life on earth. It is an established fact that the radioactivity is harmful to living beings, however small it may be. Many areas in the world such as Australia, Brazil, China, India, Iran, Japan etc., possess levels of natural radiation. The most important places among the well documented Natural HighBackground Radiation Areas (NHBRA) of the world inhabited by largepopulations are Gurapari in Brazil [1], Yangjiang in China [2], Chavara and Manavalakurichy in India [3] and Ramsar in Iran [4-6]. Natural radiationlevels in this region are higher than normal which are believed to be emitted from the rich deposits of the monazite bearing black sands. The mineral monazite contains radioactive elements which is the main cause for natural radiation in the South West Costal belt. The important localities possessing high radioactivity levels along the South West Coastal belt are the Chavara – Neendakara in Kerala Coast, and the Muttom – Midalam in the Southern TamilNadu Coast. Because the earth's bedrock contains varying amounts of radioactive elements the amount of radioactive elements and radioactivity level in water also varies. In the recent years studies on high natural background radiation areas in the world have been of prime importance for risk estimation due to long term low level whole body radiation exposures to the public with the increased public concern over radiation safety. The studies on Natural background radiation areas provide a good scope for evaluating biological effects caused by radiation exposure on a long term basis. Measurements of radioactivity were made in sediment, water and fish collected from Rajakkamangalamestury which is 7kms from Muttom a naturally High Background Radiation Area (NHBRA) in Kanyakumari district of TamilNadu India. The details of the findings are discussed in this paper.

II. Materials And Methods

Study Area

The study area is Rajakkamangalamestury near Centre for Marine Science and Technology(CMST) which is nine kms from Nagercoil, the capital of Kanyakumari district and is 7 kms nearer to Muttom a Naturally High Background Area (NHBRA) of Kanyakumari District along the South Coastal region of Tamil Nadu.

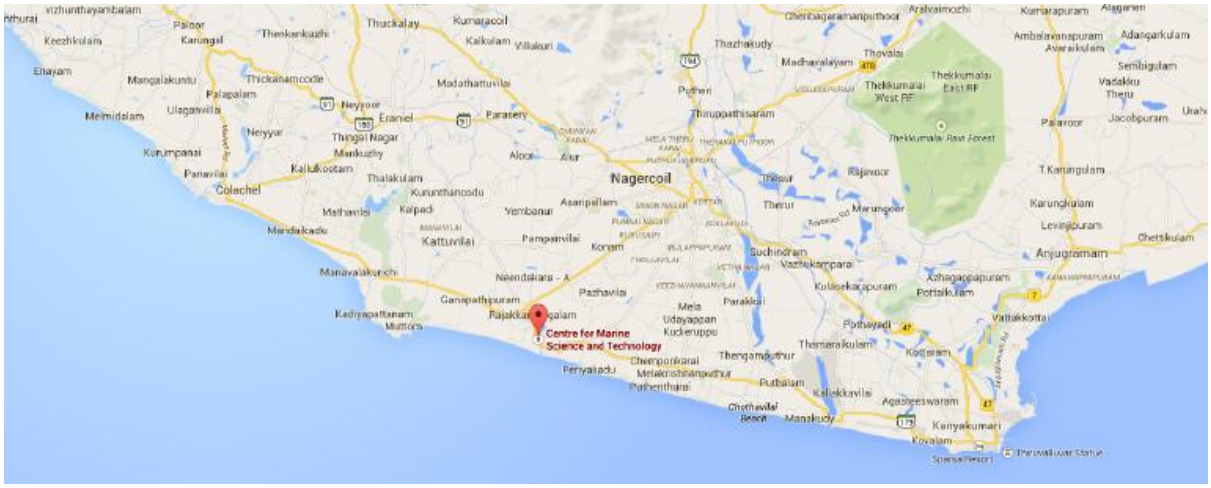

Fig 1 : Map of the Study Area

III. Sample Processing And Activity Determination

Sediment:

About 1 kg of sediment from the study area is taken and is dried in an oven at a temp of 150^0c for 4 hours. The sample is powdered with the help of agate mortar. The powdered sample is ready for radioactive analysis. Alpha, beta and gamma radiations present in the sample was determined using alpha counting system, beta counting system and Gamma ray spectrometer respectively.

Water

10 litre of water is taken and filtered using Whattmann filter paper. To the filtered water, 10 ml of 10% potassium dihydrogen orthophosphate, 2 ml of $Cacl_2$ and ammonia solution is added and is left for a night. Decand the supernatant liquid and dissolve the precipitate in con.Hcl. Reduce the volume and add 1 ml of $Con.H_2So_4$ and 1 ml of barium carrier. $BaSo_4$ Precipitate is taken in a clean and dry planchet and it is ready for analysis.

Fish

For fish about 2 gms of fish [Oreochromismossambicus species] was collected from study area. It was washed thoroughly with water and cut into pieces and dried in hot air oven at a temperature of about 150^0C for four hours. The sample is taken in a silica crucible and ashed it in muffle furnace at a temperature of about 600^0C for 4 hours and the sample is ready for analysis by using respective counting system.

IV. Result And Discussion

Table : 1 Gross α activity in samples

No	Sample	α activity
1	Sediment	114.764 Bq/kg
2	Water	0.043 Bq/l
3	fish	57.38 Bq/kg

Table 2 : Gross β activity in samples

No	Sample	β activity
1	Sediment	357.25 Bq/kg
2	Water	0.28 Bq/l
3	fish	123.67 Bq/kg

Table 3 : Radioactive nuclides in Samples

No	Sample	Radioactive nuclides Bq/kg (or) Bq/l			
		^{226}Ra	^{228}Ra	^{40}K	^{232}Th
1	Sediment	128.37	103.45	28.36	1382.5
2	Water	0.014	0.011	0.35	0.47
3	fish	33.52	27.68	73.81	87.25

From the results obtained in Table 1 : it is evident that α activity is higher in sediment with 114.764 Bq/kg than in water and fish with 0.043 Bq/l and 57.38 Bq/kg respectively . A same pattern of high β activity was reported in sediment with 357.25 Bq/kg while a mere 0.28 Bq/l was estimated in water and 123.67 Bq/kg

in fish. Gamma activity measurements reveal that ^{228}Ac was 128.37 Bq/kg in sediment, 0.014 Bq/l in water and 33.52 Bq/kg in fish. The activity concentration of 40_K in fish is higher with 73.81 Bq/kg than in sediment and water with 28.36 Bq/kg and 0.35 Bq/l respectively. 232_{Th} was reported as 1382.5 Bq/kg in sediment, 0.47 Bq/l in water and 87.25 Bq/kg in fish respectively.

V. Conclusion

The activity concentration of radioactive nuclides reported from this region are now found to be within the limit. Natural radioactivity forms a significant part of the total activity in the environment whereas anthropogenic activities have introduced significant amounts and usually their influence is limited to the near locality of their introduction. The presence of radioactivity in sediment and water is due to the deposition from atmosphere, leaching from soils and rock courses formed from dissolved ^{226}Ra and ^{222}Ra .

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