Global Scientific JOURNALS

GSJ: Volume 10, Issue 3, March 2022, Online: ISSN 2320-9186
www.globalscientificjournal.com

INVESTIGATION OF THE CONCENTRATION OF ANTHROPOGENIC RADIONUCLIDE IN SOIL SAMPLES FROM KALTUNGO AND ITS ENVIRONS.

AREMU S.O[1], Haque M.F[2], Olasoji O.W[2], Maina Ibrahim[2]

1. **Federal polytechnic Bauchi, saholabisi@fptb.edu.ng 08102970895, 08053510535.**
2. **Abubakar Tafawa Balewa University Bauchi. Bauchi State.**

Abstract

The concentration of anthropogenic radionuclide in soil samples from Kaltungo Local Government Area and its border town to Billiri, Shongom and Balanga Local Government Areas was investigated using Rigaku Energy Disperse XRF machine, GPS, analytical balance and polythene bags. Six anthropogenic radionuclides were detected with concentration ranging from 8.13ppm to 2740ppm.

Keywords: Anthropogenic, Radionuclide, Concentration, Soil.

Introduction

Environmental pollution is the contamination of the environment naturally or artificially by human activities (Nwoke, 2006). Water and soil made up of fifty percent of the environment (Patel, 1980). Hence the investigation of the quality of water and soil in an environment is necessary for public health. Natural sources of environmental pollution include but not limited to naturally occurring radioactive materials (NORM) of the earth's crust, cosmic radiation which release radionuclide into the atmosphere, rocks, flood and so on. The naturally occurring radioactive materials in the earth's crust comprise of Uranium, Thorium, and Radium with their

Radon-gas progeny and potassium 40. These materials seep into the ground water introducing radioactivity into the water (Rahaman, 1988).

Igneous rocks formed by the solidification of metals are the major component of earth's crust. These rocks are mainly silica and basaltic rock types. The major component of minerals of the rock's mineral determine the trace elements that solidified out in them (Faanu *et al*., 2011). Magnesium rocks yield chromium ores together with nickel. Basaltic rocks yield copper and zinc and granite rocks yield potassium beryllium and lead. The weathering of these rocks yields sedimentary rock and unconsolidated sediments. Rivers and streams encounter these sedimentary and igneous rocks and consequently the water is contaminated by the trace elements present in the rocks (Jabbas *et al*., 2010). Fertilizers constitute a serious pollutant as they are washed into various water bodies by flood or rain. Most fertilizers contain phosphate, potassium and nitrate products. These substances are nutrients to the plants but some of them constitute serious health risk especially to children due to interference of the chemical with blood oxygen transport (Amrani and Cherocuati, 1999). Some of the substances in fertilizer are radioactive and constitute radiological hazards to man (Mehade*et al*., 2014).

Methodology

The materials used are Polythene nylon, Geographical Positioning System (GPS), Cellulose membrane filter, analytical balance, measuring cylinder, beakers and XRF machine.

XRF is a non-destructive analytical technique used to determine the elemental composition of materials. XRF analyzers determine the concentration of an element in a sample by measuring the fluorescent (or secondary) X-ray emitted from a sample when it is excited by a primary X-ray source.

Plate1: External and Internal view of X-ray fluorescence machine

Study Area

Kaltungo is a Local Government Area of Gombe State, Nigeria. Its headquarters are in the town of Kaltungo in the west of the area on the A345 highway at 9°48′51″N 11°18′32″E. It has an area of 881 km^2 and a population of 149,805 at the 2006 census. This LGA is bounded by Akko LGA to the north; to the east and south by Balanga local government area, to the west by Shongom LGA, and to the north-west by Billiri local government area.. Farming is an important feature of the economy of Kaltungo LGA with a number of crops such as sorghum, millet, beans, and rice grown in the area. Other important economic activities in Kaltungo LGA include trade, hunting, and crafts making.

Fig 1: Area of Kaltungo and its environs

Sample Selection

A total of twenty-seven (27) soil samples were collected comprising of fifteen samples from Kaltungo local Government area and four samples each from Billiri, Balanga and Shongom local government areas respectively.

RESULTS

The tables below show the anthropogenic radionuclides found in the soil samples collected at various locations of Kaltungo, Billiri, Shongom and Balanga local government areas of Gombe State.

Table 1: Anthropogenic radionuclides in Billiri soil samples

Locality Name	Concentration (ppm)					
	Rb	Sr	Y	Zr	Nb	Ba
Bambam	47.4	63.1	14.3	493	8.70	224
Bakasi	56.6	59.0	17.0	572	10.1	244
Gelengu	67.5	76.2	33.3	1820	12.8	366
Balanga	72.3	93.8	28.0	995	14.5	291

Balanga has the highest concentration of Rb with Bambam having the least. Concentration of Y is directly proportional to the concentration of Sr except Gelengu sample that showed otherwise. Barium concentration is high at all locations.

Table 2: Anthropogenic radionuclides in Balanga soil samples

Locality Name	Concentration (ppm)					
	Rb	Sr	Y	Zr	Nb	Ba
Poshiyi	373	107	8.13	412	7.71	489
Pokolin	244	114	15.0	687	13.7	730
Ladukanshi	229	118	23.7	950	22.9	721
Kufai	211	166	21.5	1040	21.5	978

Just like other locations, Ba has the highest concentration in all samples. Rb concentration is higher than Sr concentration while Nb has the least concentration in all samples.

Table 3: Anthropogenic radionuclides in Shongom soil samples

Locality Name	Concentration (ppm)					
	Rb	Sr	Y	Zr	Nb	Ba
Lapan	228	272	77.1	916	44.9	1290
Boh	220	319	26.0	301	7.94	1010
Kulisheng	203	222	44.8	2050	61.4	1140
Lashkolto	151	73.5	15.9	526	25.8	376

Zr and Ba has the highest concentration in the soil samples. The higher the Ba concentration the higher the Nb concentration except Lashkolto sample that showed otherwise.

Table 4: Anthropogenic radionuclides in Kaltungo soil samples

Locality Name	Concentration (ppm)					
	Rb	Sr	Y	Zr	Nb	Ba
Ture	68.6	74.0	12.0	433	7.56	295
Dogon Ruwa	76.2	72.6	21.8	996	13.6	392
Sabon Kasuwa	131	106	21.8	1100	23.4	630
Awak	184	161	21.2	1370	29.4	993
Termana	191	157	13.6	590	17.3	918
Ladur	197	175	20.7	1540	35.9	938
Lambu	202	154	29.8	1150	31.9	1100
Baganje	234	253	25.9	763	23.0	1220

Popandi	248	206	47.4	858	34.6	1210
Okra	253	178	32.9	881	33.4	1120
Poshereng	274	227	48.4	1120	51.1	1230
Karolgu	284	250	35.8	1090	38.4	1420
Lapandintai	292	204	83.1	841	46.4	1220
Sabon Layi	330	256	55.6	884	42.7	1460
Kalarin	561	461	34.1	983	39.0	2740

Barium has the highest concentration with Nb and Y having the least concentration for all locations. The chart showing the average of each of the anthropogenically produced radionuclides is shown in fig 2 below.

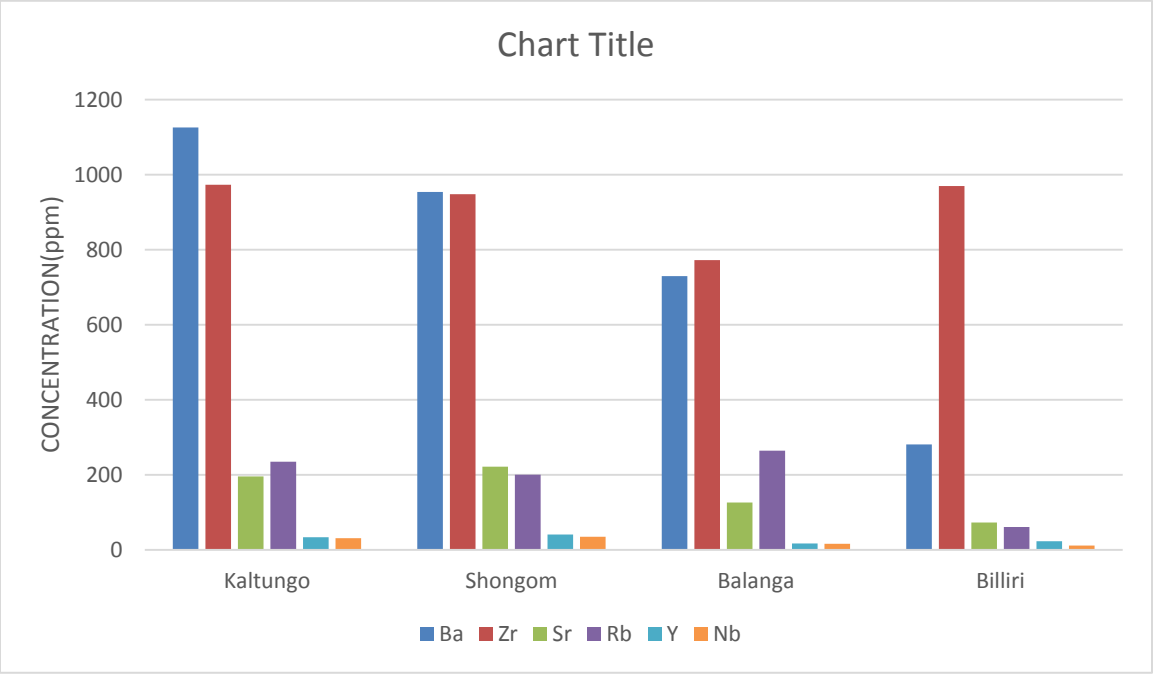

Fig 2: Chart showing the average of each of anthropogenically produced radionuclides in soil samples of Kaltungo, Shongom, Balanga and Billiri.

Conclusion

The concentration of Barium and Zr are higher at all locations compared to other radionuclides. However, their concentrations are higher at Kaltungo, Shongom and Balanga compared to Billiri. The concentrations were found to be proportional to the rate of farming activities at the sampled location. Therefore, radiological activities of the locations especially Kaltungo ang Shongom should be carried to ensure the safety of the residents.

References

Ahmed S., Abdullahi, John, S. Mathew and Chifu, E., Ndikilar (2014). An assessment of gross beta radioactivity concentration in underground water in Nassarawa town of Nassarawa state, Nigeria. International Journal of Latest Research in Science and Technology. Vol. 3, Issue 5, pg. 71-74.

Aminu Kalip, James Yusuf, and Aremu, S.O., (2020): Assessment of Radon (^{222}RN) and heavy metals in groundwater sources from Kaduna and environments in Nigeria. International Journal of Innovative Science, Engineering and Technology Vol. 7, Issue 12.

Amrani, D, and Cherouati, P.E., (1990). Health effects from radon-222 in drinking water in Algiers. Journal of Radiological Protection, 19(3), 275-279.

AndeSebugh, Patience DooshimaLorungwa and Fedison Samson, (2019). Assessment of water samples obtained from hand dug wells and boreholes around Kaltungo area. Ewemen Journal of Analytical and environmental chemistry. Vol. 5, issue 2. Pg. 229-234. http://ewemen.com/category/ejaec

Atsor, A.J., Akpa, T.C., and Akombor, A.A., (2015). Determination of gross alpha and beta radioactivity in underground water at Gboko and its environs. Rsearch Journal of Physical sciences. Vol. 3(6) pg. 1-9.

Auwari, G.O., Osimobi, J.C., Ononugbo, C.P., (2016). Gross alpha and gross beta activity concentrations and committed effective dose due to intake of water in solid mineral

producing areas of Enugu state. International journal of physics and applications, ISSN 0974-3103, vol.8(1). Pg 33-43.

Esiole, S.O., IbeanuIge, Garba N.N. and Onoja, M.A. (2019). Determination of radiological hazard indices from surface soil individuals in AngwanKawo gold mining sites Niger states, Nigeria. Journal of Applied sciences and environmental management, vol. 23(8) pg. 1541-1547. http://www.ajol.inth/index.php

F.O. Ogundare and O.I. Adekoya (2015). Gross alpha and beta radioactivity in surface soil and drinkable water around a steel processing facility. Journal of radiation research and applied sciences vol.8, pg. 411-417. http://www.elseview.com/locate/jras.

Jabbar, A., Tufail, M., Arshed, W., Bhatti, A.S., Ahmad, S.S., Akhter, P., et al., (2010). Transfer of radioactivity from soil to vegetation in Redina Doab, Pakistan. Isotopes on Environmental and Health Studies, 46(495).

Muhade Hassan, M., Ali, M.I., Paul, D., Haydar, M.A., and Islam, S.M., (2014). Natural radioactivity and assessment of associated radiation hazards in soil and water samples collected from and around Barapukoria coal, fired thermal power plant, Dinapur, Bangladesh. Journal of Nuclear and Particle Physics 4(1), 17-24. http://dx.doi.org/10.5923/jejnpp.2040401.03

Muhammed Abdulhussain Al-kaabi and Ahmed Al-Shimary: Study of the radiological dose and hazard indices in soil samples from Karbala city Iraq.

Ndawashi, M., Adeyemo, D.J., Hussaini, S.M., Aremu, S.O., Buba., D., (2018). Assessment of heavy metals concentration and pollution quantifications on waste water from water trewatment plant of Jibia. An unpublished article presented at National Institute of Physics annual conference at Niger state.

Nwoke, J.E., (2016). Measurement of gross alpha and Beta radioactivity in River Kaduna. Thesis submittd to postgraduate school, Ahmadu Bello Zari for the award of Master of Science Degree in Radiation Biophysics.

Ogundare, F.O., Adekoya, O.I., (2015). Gross alpha and beta radioactivity in Surface soil and drinkable water around a steel processing facility. Journal of radiation research and applied sciences. Pg. 411-417. http://www.elsevier.com/locateijras.

Onoja Rose, Daniel Joseph Adeyemo and Sunday Okoh (2013): Physical parameters and total radioactivity concentration sin some borehole water. Archives of applied science research 5(3) pg. 211-219. Scholars research library.

Orchan ACAR, Organ Murat Kala, OzcanYalcinkaya and Ali RehiberTurker (2013). Determination and evaluation of gross alpha and beta activity concentrations and metal levels on thermal waters from Ankara, Turkey. Turkish Journal of Chemistry. Vol. 37pg. 805-811. http://journals.trubitak.gov.tr/chem.

Orhan ACAR, Orhan Murat Kalfa, OzcanYakinkaya, Ali ReubarTurker (2013). Determination and evaluation of gross alpha and beta activity concentrations and metal levels in thermal waters from Ankara, Turkey. Turkish Journal of Chemistry. http://journal.tubitak.gov.truchem.doi:10.3906/kim-1302-8

Patel, B., (1980). Management of environment 51-76. Pg 506-509. New Delhi: Wiley Eastern.

Rahaman, M.A., (1988). Recent advances in the study of the basement complex of Nigeria Precambrian: Geology of Nigeria. Publication of the Geological Survey of Nigeria 3; Pg. 11-34.

Sultan Sahin Bal., Muhammad Faith Kuluozturk and Mahmud Dogru, (2012). The gross alpha and beta radioactivity concentration in the service (Hazig) fault zone. Journal of Britlis Even University of Science and Technology. ISSN 2146-77062, pg. 49-51.

UNSCEART (2000). Sources of ionizing radion. Report to the general assembly with annexes United Nations: United Nations Scientific Committee on the effects of Atomic Radiation, New York.

Waseem, A,m Arshad, J., Iqbal, F., Sajjad, A., Mehmood, Z., and Murtaza, G., (2014). Pollution status of Pakistan: A retrospective review on heavy metal contamination of water, soil and vegetables. Hindawi corporation Bio. Medical Research International. http://dx.doi.org/10.1154/2014/813206.