RADIALOGICAL DETERMINATION OF RADIOACTIVE ELEMENT OF MAHOGANY (Root, Stem and Leave,) AROUND NNPC REFINERY KADUNA

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ABSTRACT

Radiological determination of radioactive elements of mahogany,(Root, Stem and leave) using Gamma ray spectroscopy was carry out "The sample were collected around NNPC Refinery Kaduna State. The method used was sodium iodide Gamma ray spectroscopy detector. The result shows that ^{40}K which has 102.3, 102.9 and 102.6 Bq/kg, in mahogany (stem, root, and leave) respectively while that of soil is 102.3 Bq/kg, While for ^{226}Ra mahogany (stem, root and leave) 49.5, 40.2 and 50.9 Bq/kg while that of soil is 38.5 Bq/kg also that of ^{232}Th for mahogany (stem, root and leave) 46.1, 45.7 and 49.3, while that of soil is 53.5 Bq/kg the above result were found to be below the standard limit (Karl Heinz 2018) that all radioactive element should be within 125Bq/kg, and that of United Nation Scientific Committee on the Effect of Atomic Radiation (UNSCEAR, 2019) to be 21-145Bq/kq. It was recommended that other research of other radioactive elements in mahogany (stem, root and leave) may use little quantity of it, so that to avoid feature cancer

Keywords: Radiation, Refinery, Soil, Water.

INTRODUCTION

Uranium is a silver-white metallic chemical element in radioactive element of the periodic table with symbol U and atomic number 92. A uranium atom has 92 proton and 92 electrons which are valence electron. Uranium is a weekly radioactive because all its isotopes are unstable (with half-live of the 6 naturally, Known isotope, uranium-233 to uranium-238 carrying between 69 years and 4 ½ billion years. The most common isotopes of uranium -238 (which has 143 neutrons, accounting for almost 99.3% of the

uranium found in nature) and uranium 235 which has 143 neutrons accounting for 0.7% of the element found naturally. It occurs naturally in low concentrations of a few parts per million (ppm) in soil rock and water, and is commercially extracted from uranium bearing minerals such as uranium (Francis, 2005).

Uranium form lightly soluble carbonate complexes at alkaline P^H, this lead to an increase in mobility and availability of uranium to group water and soil form nuclear wastes which lead to health hazards. However it's difficult to precipitate (PPT) uranium as phosphate in the present of access carbonate at alkaline $_PH$. Plant absorbs some uranium form soil, dry weight concentration up to 4 ppm. Uranium in food plant is ingested through the food people eat. It's commonly found in very small amount rock, soil, water plant and animals including human being. Uranium decay very slowly despite its instability, we can still observe this isotope in nature while other radio isotopes decay completely in a matter of a second less which was not found in nature. Uranium can enter the body when it's inhaled or swallowed or under rare circumstances it may enter through wound in the body skin. The one that is outside the body is less harmful that it would be if it were in healed or swallowed. When it gets into the body it cause cancer and kidney damage. Depleted uranium which emits alpha and beta particle (such as U - 235) affects the skin while uranium that dissolved inside the water (such as ^{234}U and ^{238}U) affects the inside of the body eg. Kidney (Harthy, 1999).

Gamma-ray spectroscopy is the quantity study of the energy spectra of Gamma-ray sources in the nuclear laboratory and nuclear process and in qeo-chemical, astrophysical and other radiation measurement context. Most radioactive source produce Gamma – rays of U various energies and intensities.

Gamma – ray are electromagnetic wave their wave length run from about 10-10m to well below 10-14m, with corresponding frequency range from $3x10^{18}H_z$ to move the $3x10^{22}H_z$ γ-rays are produced by many radioactive substances. There are many application of γ -rays are absorbed by a living organizing e.g human, they may cause serious effects, therefore it's necessary to find out same substances that can absorb and block γ –rays

Gamma ray radiation form radiation from radioactive such 40k and the ^{232}U the and ^{238}U series and their decay products, represents the main external source of irradiation to human body, the penetrating absorb them. In order to ensure radiation safely in the various application of ionizing radiation technology certain producers must be put in place to reserve exposure levers to their maximum.

Uranium derived primary from earth's crust contains trace of naturally occurring radioactivity which decays spontaneous in to more stable forms emitting alpha (α) Beta (β) and Y radiation during the process. These emitted radiations are of serious concert in view of their radiological implication to man and environment. It also shows that these materials are also known to be the primary sources of exposure to natural radio radionuclide to human population, (Francis 2005). in our society, there is high level of ignorance about natural radio activities in leaf, stem and roots which have great radiological effects on human when exposed to it whether prolonged or short time exposure, it is dangerous because the effect depends on the absorbed dose. The present research determine the concentration level of radioactive elements in, leaf, stem, root of Mahogany tree using gamma – ray spectroscopy. Also the work will bring about awareness to the general public especially people living in that area of the present of radioactive element in leaf, stem and roots; which will make them to reduce the too much taking those leaf, stem and roots as a local medicine in present.

METHODOLOGY

SAMPLE COLLECTION

The sample was collected at NNPC Kaduna the soil from where the tree grow was also collected in case of any variation, three different sample was collected such as stem, roots and leaves of Mahogany the sample label as shown in the table for easy identification.

Samples	Samples label	Samples location
Mahogany stem	A1	NNPC Kaduna
Mahogany roots	A2	NNPC Kaduna
Mahogany leaves	A3	NNPC Kaduna
Mahogany soil	A4	NNPC Kaduna

Table 1 sample collection

SAMPLE PREPARATION

The tree root, stem and leave was collected and dried after which pounded with mortal and pestle to fine powder so as to obtain uniformly homogenous sample. The same was done to the soil with crushing machine to powder form.

The sample each was filled into the plastic container of known weight, the weight of the sample and the container was then measured using weight balance. The inner portion of the lid of the plastic container is being coated with Vaseline and then Candle Wax first.

Followed by sealing with the masking tape, the plastic glove is being change after every sample prepares to avoid cross contamination. The weight of the samples was obtained by subtracting the weight of the empty container from the weight of the sample and the date of sealing are recorded to avoid sample loss.

The sample was kept for at least the period of 28 days for equilibrium (i.e the period for which all the radionuclide is expected to have formed a saturated mixture) after which the sample can be counted for the gamma spectroscopy using the sodium iodide detector to determine the low background level of uranium. (Which are daughters of Uranium Ra, and Th)

SODIUM IODIDE DETECTOR PRINCIPLE

The sodium iodide detector is covered with the shield to detector is connected to prevent background radiation, as to capture only the signal from the sample, the amplifier and to the system for counting. Amplifier preamplifier and voltage was set ON. The voltage was set to 900v and detector was calibrated using ^{137}Cs and ^{60}Co before counting to known the position of the sample and to keep the voltage ok, the connection of the sodium iodide gamma ray spectroscopy detector.

The sample each was place inside the detector and covered the container of the sample was cut according to the shape of the detector. The MAESTRO which is an accusation software for counting (was a program in the system which was been used for that purpose), was clicked ON the system and the time for counting was set (i.e 29000 seconds) then the start counting menu was click ON and the value of radioactive in each was read and recorded using the peak of the signal on the system.

The signal display by detector on the system is the force or the voltage which helps to detect the radioactive element in the sample such as ^{40}k, ^{232}Th, ^{226}Ra.

RESULT AND DISCUSSION

The result of the radioactive element in the mahogany, root, stem, leaf and the soil is shown below

S/No	**Sample Id**	**K-40 (Bq/Kg)**	**Ra-226 (Bq/kg)**	**Th-232 (Bq/kg)**
1	A1(mahagany) stem	102.3284	49.5366	46.0595
	A2 (Root)	102.876	40.2329	45.6654
	A3 leaves	102.5672	50.9347	49.2644
	A4 soil	102.3284	38.5195	53.4551

DISCUSSION

The result presented in the table above shows the concentration level of the daughters, of uranium 238 (^{238}U) i.e ^{40}K, ^{226}Ra, and ^{232}Th. K= potassium, Ra = Radium and Th = Thorium in the three different and soil collected at NNPC physics Kaduna.

It was shown by the result that, the ^{40}K is equal in both the soil and the mahogany (stem, root and leaves). While in the case of Ra is a little higher in the mahogany (stem, root and leaves) than in the soil, i.e the mahogany (stem, root and leaves) itself has more of the ^{226}Ra. it is almost the same but still that of soil is higher than that of the mahogany (stem, root and leaves).

According to Karl Heinz (2018), all radioactive element standard limit value is 125 Bq/kq, with these standard, it was found that the ^{40}K

CONCLUSION

From the discussion above, the mohogany (stem, root and leaves) are within the standard limit i.e Mahogany (stem, root and leaves) such as ^{40}K which has 102.3284, 102.876 and 102.5672 Bq/kg, in mahogany (stem, root and leave). While for 226Ra mahogany (stem, root and leave) 49.5366, 40.2329 and 50.9347 Bq/kg also for that of 232Th for mahogany (stem, root and leave) 46.0596, 45.6654 and 49.2644,

Meaning all the tree (stem, root and leave) are fit to be use as medicine and should be consume as desire.

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