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Studying the Background Radiation from the Soil of Halabja City.

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Abstract

On 16th March 1988, Halabja city in Sulaimany region of Iraq was bombarded by chemical bombs of Saddam's regium. Therefore, it is necessary to determine the level of radioactivity from the soil, the water, and the air in that region. For this purpose two samples of soils are taken .One from Shahidan and the other from Kani-Ashkan regions in Halabja city been taken and analyzed in Iraqi Atomic Energy Agency in 2001,by using the γ-ray spectrometer including the HPGe detector. The radio nuclides of Radium (Ra-226), Lead (Pb-214), Iodine (I-133), Bismuth (Bi-214), Actinium (Ac-228), and Potassium (K-40), have been identified.

Keywords: (Natural Radioactivity, Specific Activity, U-238, Th-234, K-40)

Introduction:

It is very difficult to investigate or monitor the radioactivity of any region without the existence of previous data concerning the radioactivity level of that region. Therefore, measuring the radioactivity of soil, rock, water, and air is necessary and gives much information for doing research about the region. It is necessary to determine the radionuclides with their radioactivities and then comparing them with standard values to calculate the exceed ratio activity of the region.

Gamma rays were measured in the energy range from (92.8 to 1460) KeV with a planner HPGe detector of 2 cm^3 volume with an energy resolution $\Delta E\gamma$=580 eV for (Co-57), and the source to detector distance of d=10 cm. The higher range γ-quanta were recorded with a coaxial HPGe detector of efficiency $\epsilon\gamma$=20% and resolution $\Delta E\gamma$ = 2.2 KeV (for Co-60), [1].

Energy Calibration of HPGe Detector:

In gamma ray spectroscopy with HPGe detectors, the pulse height scale must be calibrated in terms of absolute gamma-ray energy of various peaks in the spectrum which are to be properly identified. The energy calibration of HPGe gamma-ray spectrometer is performed by means of a set of radioactive standard sources and "internal calibration" approach. The background source and standard source of nearly equal intensities were placed at the same strictly defined distance from the detector. Accurate calibration should involve standard sources with gamma-ray energies that are not widely different from those to be measured in the unknown spectrum. Because, even the best spectrometer system often shows non linearity of a channel or two over a full range of several thousand channels. It is also useful to have multiple calibration peaks at various points along the measured energy range to account for these linearity.

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Those γ-ray energies which had been measured with the planner detector were determined with the help of the standard gamma-ray source Eu-152. Purity of the "calibrating" peaks in the measurements of the background decay, in the presence of a standard source, was checked by comparison of their intensities in the present spectra to adopted one [1].

Efficiency Calibration of the HPGe Detector

In gamma-ray spectrometry Ge(Li) or HPGe detector very often requires an accurate knowledge of the detector efficiency. Many analytical functions have been suggested for Ge(Li) detector efficiency. Some of the functions have a semi-empirical formula based on physical parameters of the detector. The standard source (Eu-152) with known activity has been used for calibration in the energy range (121.8-1409.1) KeV. The counting time was 3600 sec for obtaining the source spectrum with measuring the efficiency of the detector by using the following equation [2 - 4]:

$$Eff\,\% = \frac{\sum N/t}{A * I} \quad \ldots\ldots\ldots(1)$$

Where N: is the net count under peak
t: is the time of measurement
A: is the activity of the source
I: is the relative intensity

Sampling

Two samples at depth of about 30cm and mass of 1kg soil from two different regions of Halabja city with a separation of 500m have been taken in a nylon container after releasing the large particles, which is by using the clasp with 2mm holes. The samples were dried using thermal oven at temperature 80°C for 24 hrs for taking constant weights and then putting them into a Marnelli beaker for counting [2].

Operation Method

After preparing the samples and performing the calibration, the samples were brought in front of the HPGe detector. The detector contains a crystals of volume 100 cm^3 on (P) type (Model CP-2019), which has relative efficiency 20% and energy resolution of 2.2 KeV for Co-60 energy of 1332.5 KeV and the operation voltage is about 1400V(Tennelec-W.Germany). The net spectrum of each sample has been collected for 24 hrs, after subtracting the background collected for the same period of time, and the following relation has been used to calculate the specific activity [4,5]:

$$specific\ activity = \frac{N/t - B \cdot G}{I\% * Eff\% * m} \quad \ldots.(2)$$

Where:

N/t is the net count or net area under the peak.
I is the intensity.
Eff. is the efficiency of the detector for the known specimen existed energy= 20%
t is the counting time for each sample = 24 hrs.
m is the mass of sample =1 Kg.
B.G is the background.

Results and Discussion

The obtained data from the soil sample analysis of Kani-Ashkan and Shahidan quarters are listed in Tables (1 and 2). Throughout the work, some radio nuclides and their activities were detected which are: (Radium-226, Lead-214, Iodin-133, Bismuth-214, Actinium-228 and Potassium-40) .The energy of these radio nuclides and their radio activities have been determined where Ra-226, Pb-214 and Bi-214 belongs to U-238 series, Th-234 and Ac-228 belongs to Th-234 series [6].

Table (1): The background radiation from Kani-Ashkan soil sample.

Radionuclide	Energy (KeV)	Radioactivity Bq/kg	Half life/yr
Ra-226	186.21	109	1600
Pb-214	241.98	158	1600
Pb-214	295.21	20.4	1600
Pb-214	351.92	17.9	1600
I-133	510.57	145.7	20.8h
Pb-214	580.16	651.0	1600
Bi-214	609.31	18.3	1600
Bi-214	665.45	337	1660
Ac-228	911.07	29.1	$1.4*10^{10}$
K-40	1460.75	309.3	0.128

Table(2): The background radiation from Shahidan soil sample.

Radionuclide	Energy (KeV)	Radioactivity Bq/kg	Half life/yr
Th-234	92.8	140.23	$4.7*10^{10}$
Ra-226	186.21	113.65	1600
Pb-214	241.98	165.811	1600
Pb-214	295.21	16.781	1600
Ac-228	338.4	32.422	$1.4*10^{10}$
Pb-214	351.92	22.235	1600
Pb-214	580.16	1411.182	1600
Bi-214	609.31	12.712	1600
Bi-214	665.45	337.425	1600
Ac-228	911.07	24.837	$1.4*10^{10}$
Ac-228	969.11	29.776	$1.4*10^{10}$

The radio activities for Ra-226 in these regions: Shahidan and Kani-Ashkan in Halabja city, were higher than normal range which is between (30-40) Bq/kg [5]. While for Pb-214 and at the energies (241.98, 295.21, 351.92, and 580.15) KeV had approximately the same values as normal [7], except at the energy 580.16 KeV, where the sample of Shahidan has a double value in comparison with that of Kani-Ashkan.

From soil of Shahidan, and for Th-234 at the energy 92.8KeV the value of activity was 140.23 Bq/kg (see Table 2), whereas the normal value is about 40 Bq/kg [7]. Also, the Ac-228 at energy 911.07KeV in these two regions shows the same values, but in Shahidan at energies (338.4-961.11) KeV reveals a low account rate. The Bi-214 at the energy 609.95 KeV had approximately the same normal range of activity [6].

For I-133 at energy of 510.57 KeV the activity was 145.7 Bq/kg in Kani-Ashkan soil while it was not found in Shahidan district. The K-40 at energy 1460.75 KeV had activity of 309.3 Bq/kg. This value was the same as that in southern part of Iraq [6], Basra region which bombarded with atomic bombs during the 1991war,and also it was the same range as that in southern part of the west bank, Palestine and in soil cores in Araba valley, Jordan [7,8]. Observing these results of radio activity which exceeds the normal may ascribed to many different factors mainly a contamination from other regions caused by the change of weather such as raining, the high speed of winds, and the war which occurred during 1988 in that region.

Moreover, Iraqi Government used chemical bombs in the same year to the same region where the chemical compounds encouraged the accumulation of the radio nuclides.

Conclusion

In the present work, the most radio nuclides existed approximately at the same range of activity, except I-133 with energy 510.52 KeV and K-40 with energy 1460.7KeV which were in the soil of Kani-Ashkan while they were not found in the soil of Shahidan. Moreover, Th-234 with energy 92.8 KeV and Ac-228 with energies

(338.41 and 969.11) KeV were found in Shahidan soil, but they were not found in the soil of Kani-Ashkan.

As one who knows that the main factors which affect the radio nuclides and their activities are due to the change of weather and taking place of war as well as using different weapons which were affecting the background activity. Since these radioactivity materials exist widely in the background, so it may be a great factor of the cancer disease which is found widely in Halabja region since that time.

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لێکۆڵینەوەیەك لەسەر توانای تیشکاوەری سروشتی لە خولی هەڵە بجەدا

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پوختە

لەساڵی 1988 **ناوچەی هەڵە بجە سەربەشاری سلێمانی کەئەکەوێتە ناوچەی هەرێمی کوردستان لەباکوری خۆرهەڵاتی عێراق لە ئەنجامی شەڕێکی درێژ خایەنی نێوان عێراق و ئێران تووشی بۆمبارانی کیمیایی هات لەبەر ئەوە زۆر پێویستە کەئاستی تیشکاوەری بۆ ئەنجام بدرێت کەتاییەت بێت بە خۆڵ و ئاووهەوای ئەو ناوچەیە. لەتوێژینەوەکەمان دوونموونە لەخۆڵی ئەو ناوچەیە کەیەکێکیان لە گەڕەکی شەهیدان ئەوی تریان لە کانی عاشقان سەر بە هەڵە بجەی شەهید وەرکیراوە کەئەم دووناوچەیە زۆرتر لەشوێنەکانی تر کاریگەری وێرانکاری پێوە دیاربوو بۆ ئەم مەبەستە بەبەکارهێنانی سیستەمی شیکەرەوەی شەبەنگی تیشکی گاما کە دۆزەرەوەی جەرمانیۆمی پوختی تیا بەکار هاتبوو کە لەساڵی** 2001 **لە رێکخراوی ووزەی ئەتۆمی عێراقی ئەنجام درا بوو لیکولینەوە بو ئەم دوو نموونە خولە کرا. وەتوانرا هەندێ لەتوخمە تیشکاوەریەکان دەست نیشان بکرێت کە گرنگترینیان (رادیۆم-** 226 **،قورقوشم-** 214 **،بزموث-** 214 **،یۆد** 131- **،ئەکتینیۆم-** 228**، پۆتاسیۆم-** 40 **، لەگەڵ توانای تیشکاوەریەکانیان لەو ناوچەیەدا وە بینرا کە رادەی تیشکاوەری زۆربەی ئەم تیشکاوەرانە لە ئاستی ئاساییان بەرزترە.**

دراسة الخلفية الاشعاعية لتربة حلبجة

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الخلاصة

تعرضت منطقةحلبجه التابعة لمدينة السليمانية فى اقليم كردستان الواقعة شمال شرق العراق فى عام 1988 للقصف بالاسلحة الكمياويةنتيجة الحرب بين العراق وايران ، لذلك استوجبت ضرورة دراسة مستويات النشاط الاشعاعى لتربة ومياه و مناخ المنطقة. لذلك قمنا باخذ نموذجين من التربة فى منطقتين مختلفتين الاكثرتضررا وتدميرا او لهما محلة شهيدان والاخرى فى محلة كانى عاشقان ، وباستخدام منظومة تحليل اطياف **گاما** التى تتضمن كاشف جرمانيوم عالى النقاوه فى منظمة الطاقة الذ رية العراقية تم فحص النموذجين فى سنة 2001 وقيست النشاط الاشعاعى وحصلنا على نويدات مشعة اهمها : راديوم -226 ،الرصاص - 214 ،اليود - 131،اكتنيوم - 228 ،البوتاسيوم - 40 ،البزموث – 214 حيث سجلت مستويات اشعاعية عالية (فوق المسموح بها) لاكثرية النويات المدكورة .

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