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BIOLOGECAL RADIATION HAZARDS OF SOME FERTILIZER BRANDS IN UPPER EGYPT

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The radiological hazard that resulting by using of some chemical fertilizer kinds in Egypt have beendetermined.In this study gamma spectrometry (HPGe) detectorwas employed in order to measuring amounts of natural radionuclides (^{226}Ra, ^{232}Th and ^{40}K) . The output average activity concentrations of ^{226}Ra , ^{232}Th and ^{40}K were 2.9 ± 0.9 to 3060 ± 562 , 4.7 ± 1.6 To 277 ± 43.1 and 15 ± 2.1 to 806 ± 259 $BqKg^{-1}$,respectively.We calculated the radiological hazards each of, radium equivalent activity (R_{aeq}),external (Hex) and internal (Hin) indices and annual effective dose due to the existent of these radionuclides in the selected samples. The obtained results were compared with the reported data from other countries.

1- Introduction

Natural radioactivity originates mainly from the primordial radionuclides, like ^{40}K , and the radionuclides from ^{238}U and ^{232}Th series and their decay products, which are present at trace levels in all ground formations [1].In soil the natural radioactivity may vary considerably from one type to other. One source of radioactivity other than those of natural origin is mainly due to use of fertilizer which is rich with phosphate and accordingly the radioactive ^{40}K used for agricultural purpose is one source of radioactivity other than those of natural origin [2].Fertilizers are chemical compounds that giveneedfulchemical elements and nutrients to the plants. Fertilizers have become essential in the agricultural field all over the world. Different kindof fertilizers used forincrease the crop production and to improve the nutrient-deficient properties of lands in agricultural purposes as essential components of agricultural activities. Fertilizers that use in the agriculture field contain traces of heavy metals

and relatively high concentrations of naturally occurring Radionuclides. Phosphate containing fertilizers have been usedveryworldwide to increase the quantities of the micronutrients, which are being continuously taken off from the soil due to agricultural activities. In the same time, use of fertilizers is the main anthropogenic source of the uranium input in the environment (about 73 % of the total input of uranium) [3]. Phosphate rock is used mostly for manufacturing and phosphate rock contains radionuclides of the U and Th natural decay series. The mining and processing of this phosphate rock apportions radionuclides throughout the environment and present them into the final products and byproducts [4].We found that the use of different categories of fertilizers in the agricultural fields for the purpose of enhancing crop yield still very common nowadays; fertilizers are usually used in reclaiming the land and improving the properties of plants such as crops. Using phosphate fertilizers over a period of many years could ultimately increase the radium and uranium content of the soil and consequently increase the radiation dose which give to human bodywould result in the corresponding increase of the dose and causes diseases for it[5].

2- MATERIALS AND METHODS

2.1. Sample Description and Preparation

Fifty nine fertilizer samples of 9 different brands were collected from local market in Qena governorate. All brands of fertilizers are solid. After collection thesamples were crushed to homogeneous powder 200 mm mesh, which is the optimum size enriched in heavy minerals and weighted . The samples were placed in a polyethylene simplified beaker 200 Cm^3volumes each. All beakers have been sealed to preempts the escape of ^{222} Rngaseousfrom the samples and still for about 30 days to achieve secular equilibrium between ^{226}Ra and ^{232}Th andtheir decay products, where the disintegrationrate of the progeny becomes equal the disintegrationrate of the parent (radium and thorium) within the volume and the progeny will also remain in the sample [7]

2.2. Radiometric Analysis

For gamma spectrometry analysis, all samples were analyzed after collection by low-background gamma spectroscopy using HPGe detector (Canberra, GR4020 model) with relative efficiency 40%for 3″ x 3″ NaI(Tl) crystal, and energy resolution of 2 KeV at the 1332 KeV gamma of ^{60}Co .The detector was shielded with 6.22 Cm thick lead well

internally lined with 0.6 mm carbon composite. The detector output was connected to spectroscopy amplifier (Canberra, Model, 2002CSL).The energy calibration for the system is carried out with using point sources of (^{133}Ba, ^{60}Co, ^{137}Cs, ^{54}Mg, ^{22}Na and ^{65}Zn).This spectrometer was equipped with LabSOCSs (Laboratory Source less Calibration Software). Basic calibration measurements had been done at the factory; results were used to establish the detector's characterization file. The LabSOCSs calibration tool takes into account the sample to detector geometry,composition sample and density, as well as measurement container properties. To validate and check the efficiency data supplied by LabSOCSs, measurements were prepared in our laboratory by using a set of calibrated point sources,(^{133}Ba,^{60}Co and ^{137}Cs) positioned at a distances between 0 and 15 cm from the detector end-cap. The calculated results show good agreement between mathematical and empirical peak efficiencies with differences less than 10%.

For spectral analysis, we usesoftware Genie 2000 (Canberra's, USA) . The counting time of the measurements was verified between 28863.7 to 163790 s for activity or background. To determine the background radiation level, we use an empty simplified beaker counted at the same time as the samples under identical geometry. The background spectra were used to correct the net peak area of gamma rays of measured isotopes. The ^{226}Ra radionuclide have been estimated from the351.9keV (36.7 %) gamma peak of ^{214}Pb and 609.3keV (46.1 %), 1120.3keV (15 %) and 1764keV (15.9 %) gamma peaks of ^{214}Bi. On the other hand the ^{232}Th radionuclide was estimated from the 911.2 keV (29 %) gamma peak of ^{228}Ac, the238.6keV (43.6 %) gamma peak of ^{212}Pb and 2614 keV gamma ray from ^{208}Tl . While the ^{40}K radionuclide was estimated using the 1461 keV (10.7 %) gamma peak from ^{40}K itself.

2.3. Activity Concentration:

The calculations of the activity concentration (Ac) values for radionuclides from the ^{235}U , ^{238}U and ^{232}Th series and ^{40}K determined as [8]:

$$Ac = C_{net}\gamma \times \varepsilon \times M \times t \rightarrow [1]$$

Where C_{net}denoted peak net counts, γ denoted the emission probability of specific energy peak, ε is the absolute efficiency of the full energy peak of the detector, M is the mass sample in Kg and t is the time of count.

2.4. The Radium Equivalent Activity:

Exposure to radiation has been defined in terms of radium equivalent activity (Ra_{eq}) in Bq kg^{-1} to compare the specific activity of materials containing variable amounts of (^{226}Ra , ^{232}Th and ^{40}K).It is calculated by the following relation [9]:

$$Ra_{eq} = C_{Ra} + 1.43C_{Th} + 0.077C_K \rightarrow [2]$$

Where C_{Ra} , C_{Th} and C_K are the activity concentrations of Ra, Th and K ($Bqkg^{-1}$), respectively. The radium equivalent activities (Ra_{eq}) have been calculated on the estimation that 370 $Bqkg^{-1}$ (10 $pCi.g^{-1}$) ^{226}Ra , 259 Bq kg^{-1} (7 $pCi.g^{-1}$) ^{232}Th or4810 Bq kg^{-1} (130 $pCi.g^{-1}$) ^{40}K produce the same gamma-ray dose rate [10].

2.5. Absorbed Dose Rate

The absorbed dose rate in air has been calculated by using the specific dose rates given in EC (1999). Dose rate indoors are calculated according to the EC (1999) for materials under investigationby:

$$D = 0.12 * C_{Ra} + 0.14 * C_{Th} + 0.0096 * C_k \rightarrow [3]$$

Where C_{Ra} , C_{Th} and C_K are the concentrations (in Bq kg^{-1}) of radium, thorium and potassium, respectively.

2.6. Internal and External Hazard

Radon and its short-lived products are harmed to human respiratorysystem . The internal exposure to radon and its progeny products are quantified by the internal hazard index (Hin), which is determined by [10]

$$H_{in} = \frac{C_{Ra}}{185} + \frac{C_{Th}}{259} + \frac{C_K}{4810} \leq 1 \rightarrow [4]$$

Where C_{Ra}, C_{Th} and C_K are the activity concentrations of ^{226}Ra, ^{232}Th and ^{40}K (Bqkg^{-1}), respectively.

The external hazard index (Hex) is determined by [10]

$$H_{ex} = \frac{C_{Ra}}{370} + \frac{C_{Th}}{259} + \frac{C_K}{4810} \leq 1 \rightarrow [5]$$

Where C_{Ra}, C_{Th} and C_K are the activity concentrations of ^{226}Ra, ^{232}Th and ^{40}K. respectively.

2.7. Gamma Index (I_γ)

The gamma-index (I_γ) was calculated by the European Commission equation [11]:

$$I\gamma = 0.0067 * C_{Ra} + 0.01 * C_{Th} + 0.00067 * C_K \rightarrow [6]$$

Where C_{Ra}, C_{Th} and C_K are the activity concentrations of ^{226}Ra, ^{232}Th and ^{40}K. Respectively.

2.8. Annual Effective Dose

The AED can be calculated as follow [12]:

$$AED(\frac{\mu sv}{y}) = D(\frac{nGy}{y}) \times 8760(\frac{h}{y}) \times 0.2 \times 0.8(\frac{sv}{Gy}) \times 10\text{^-3} \rightarrow [7]$$

3- Results and Discussion:

3.1. Chemical Composition

Chemical analyses for some samples under investigation have been done by XRF techn in the (Central laboratory South valley University) Qena-Egypt. We chose one sample from each of one brands of fertilizer analysis for the major chemical element oxides and the major element oxides , The results have been listed in Table 1. and table 2

Table 1. Chemical Composition (vol %) of two fertilizer Samples (elements)

Sample	Mg Si CaMn Fe S P Sr V
CY mixed urea	3.4372 1.9625 62.4779 — 8.7872 12.4221 10.1134 0.9797 —
NF fermix nitrate	6.1890 3.1248 68.9139 1.9885 15.4260 — —2.5117 1.8462

Table 2. Chemical Composition (vol %) of other Studied fertilizer Samples (oxides)

	Flt (super phosphate)	My (urea magnesium)	N urea nitrate	NT talkha nitrate	NY spcial urea abu qeer	T talkh urea	Y urea abu qeer
SiO_2	4.2555	—	—	10.8387	—	—	—
P_2O_5	14.8361	—	—	—	—	—	—
SO_3	35.0193	—	—	—	85.8769	—	—
CaO	42.2186	5.2177	67.2122	15.2964	12.8278	14.4600	69.5735
Fe_2O_3	2.3781	0.8339	—	52.0824	—	—	25.6605
CdO	1.2924	—	4.2286	3.7899	—	81.6171	—
MgO	—	12.9523	23.6171	—	—	—	—
	—	0.2249	—	—	0.5824	0.8590	—
	—	0.9059	—	—	—	—	—
	—	0.3903	—	—	—	—	—

CuO	—	—	—	—	—	—	2.0407
Re_2O_7	—	—	1.9254	1.0418	—	—	—
Au_2O_3	—	—	3.0167	—	—	—	—
MnO	—	—	—	0.9043	0.3707	—	—
CeO_2	—	—	—	—	0.1425	—	—
WO_3	—	—	—	—	0.1997	0.6094	—
Ga_2O_3	—	—	—	—	—	1.4804	—
Rb_2O	—	—	—	—	—	0.9741	1.8413
HgO			—	—	—	—	0.8839
ZnO			—	—	—	—	
Ta_2O_5							
Ir_2O_3							
SrO							
Nb_2O_5							

3.2. Activity Concentrations and Radiological Hazards

This study is a cooperation betweenphysics department -faculty of science, Assiut university, Egypt and physics department - faculty of science, Al-Azhar university, Assiut branch, Egypt and, related to measurement the specific activity of ^{226}Ra, ^{232}Th and ^{40}K in some fertilizer samples from Upper Egypt using a gamma-ray spectrometric technique and estimation of the resulting gamma dose rate. The obtained average activity concentrations of ^{226}Ra, ^{232}Th and ^{40}K for each of measured sample together with their corresponding total uncertainties are summarized in Table 3. Where Figure 1, shows a comparison between the activity concentrations in Bqkg^{-1} for the all fertilizer samples under investigation.

Table 3. Average Radioactivity Concentration in all the fertilizer samples

Type	ActivityConcentration(Bq/kg)		
	Ra-226	Th-232	K-40
AQ-N-33%(N)	21.3±10.7 24.4±12.3 20.7±8.25 30.6±7.4 24.6±8.4 24.1±12.1 81.6±19.1 7.02±2.25 26.6±11.7	15.7±6.9 9.3±4.8 12.1±7.2 13.5±6.6 8±5.2 13.2±7.6 17.4±3.7 10.6±7.7 16.8±7.3	36.2±5.9 28.8±3.6 27.1±3.3 44.7±6 55.3±15.2 41.6±6.3 24.3±6.3 86.3±21.7 51±12.3
Mean	29±10.3	13±6.3	43.9±8.9
AQ-nU-46.5% (Ny)	45.9 ± 16.8 45.1± 22.3 47.5 ±21.7 36.3 ± 15.1 58 ±20.4 27.3 ±10.2 33.2±9.4 68.7 ±29.8 52 ±18	22.5±13 25.3±11.4 13.9±7.1 9.1 ±6.9 27.8±13.5 26.5±13.6 13.9±8.9 19.2 ±11.6 10.9 ±7.3	62.8±13.5 61.9±13.2 62±12.5 67±9.1 70.5±21.4 71.9±15.8 86.1±30.2 71.3±12.9 52.2±7.8
Mean	46 ± 18.2	18.8 ± 10.4	67.3 ±15.1

AQ-U-46.5% (Y)	48.3±15.7 42.4±17.6 48.7±15.4 44.9±28.1 53.7±17.6 43.7±19.1 32±9.3 36.5±11.5 23.8±10.4	27.7 ± 12.4 30.6 ±12.9 21.1±9.4 34.9 ±16.2 24.8 ±13.9 14.4 ±9.4 11.3 ±7.5 20 ±11.3 35.6±21	51.3±25.8 55.8±18.7 93.9±15.9 59.8±10.3 63.3±10.7 56.7±8.8 52.2±10.1 69.7±14.7 56.6±9.4
Mean	41.5±16.1	24.5±12.7	62.1±13.8
Tal-U-46.5% (T)	43.6±29.7 53.9±15.2 65.2±23.1 46.7±18 51.9±19.6 56.1±16.7 34.1±13 33.9±17.8 27.1±13.8	23.8±14.7 20±9.1 17.5±8.3 7.6±4.9 24.4±10.1 22.2±8.9 12.6±9.4 12.3±8.7 15.5±7.1	24.8±2.8 78.7±44.9 65.7±16.3 59.7±8.7 73.6±20.5 51±5.7 59±9.97 46.3±7.4 60±11.2
Mean	45.8±18.5	17.3±9	57.6±14.2
AQ-Um (My)	5.3±2.3 4.1±1 2.9±0.9	8.02±3.2 4.7±1.6 4.8±1.7	76.8±27.1 48.8±5.6 67.1±20.1
Mean	4.1±1.4	5.5±2.2	64.2±17.6
AQ-U-Mixed (Cy)	514±104 475±87.7 556±105 592±128 647±121 527±96.5	27.8±8.8 62.4±11.3 33.4±10.1 77.4±17.2 72.1±12.5 36.1±8.6	52±9.7 54.7±7.1 46.9±7.6 39.7±5.3 56.9±5.9 52.1±7.7
Mean	552±107	51.5±11.4	50.4±7.2
Abo zabel super phosphate(FLT)	1920±356 2750±556 3060±562	71.4±14.1 103±15 277±43.1	15±2.1 15.6±1.3 27.1±2.4
Mean	2570±491	150±24.1	19.2±1.9

Fermexnitrate (NF)	98.2±23 476±109 502±108 191±46.6 206±52.9 262±60.4	13.5±5.3 60.8±16.6 32.6±10 18.3±13.3 20.4±12 36.8±16.1	18.9±3 24.1±3.6 31.5±5.2 258±25.6 531±78.7 806±259
Mean	289±66.7	30.4±12.1	278±62.6
Tal-N-33.5% (T)	36.4±13.7 37.1±19.4 29±14.6 38.7±10.8 56.5±20.7	13.4±9.9 13.4±9.4 16.6±7.5 7.4±4.1 12.9±6.95	44.9±5 73.9±41.3 74.8±20.66 26.7±7.3 92.5±14.3
Mean	39.6±15.8	12.7±15.8	62.6±18.9

From the results, it can be seen that, the values of specific activity concentrations in the samples under investigation varied from 2.9 ± 0.9 to 3060 ± 562, 4.7 ± 1.6 To 277 ± 43.1and from 15 ± 2.1 to 806 ± 259 Bqkg^{-1} for ^{226}Ra, ^{232}Th and ^{40}K respectively. The variation of radionuclides concentration in studied chemical fertilizers may be due to the different sources of raw material and chemical processing of the raw during fertilizer manufacture. The lowest (2.9 Bq kg^{-1}) activity concentration of ^{226}Ra is found in urea magnesium (my), while the largest value (3060 Bq kg^{-1}) in abo zabelsuper phosphate (FLT) . In ^{232}Th activity the lowest value is 4.7 Bq kg^{-1}, found in urea magnesium (my), and the highest is 277 Bq kg^{-1} found in abo zabelsuper phosphate (FLT).Figure 1; Show the relative concentration of ^{226}Ra, ^{232}Th and ^{40}K to the total activity in the samples. From thefigure, we found that the specific activity concentration due to ^{226}Ra is the largest contributor to the total activity for NF,CYand FLT.While, the specific activity concentration due to ^{40}K is the largest contributor to the total activity for other samples.

To determine the radiological hazard of fertilizer samples used in (Qena) Egypt, we calculate the radium equivalent activities (Ra_{eq}), the indoor absorbed dose rate, internal and external hazard, gamma radiation hazard index and annual effective dose and annual effective dose rate and listed in Table 4.

From Table 4, it is observed that the values of radium equivalent in fertilizers samples are lower than the allowed maximum value of 370 Bq

kg^{-1} [10] except for NF,CY and FLT and fluctuate from 17.4 to 2790 Bq^{-1}. ^{226}Ra is the main contributor to Ra_{eq} in NF,CY and FLT, while ^{40}k is main contributor to Ra_{eq} in other fertilizers.

The calculated $I_{\gamma r}$ values for the samples under investigation are given in Table 4. It seen that fertilizers samples lower than unity [13], except in FLT(9.33) ,NF(1.19) and CY(2.11) fertilizers.

As listed in Table 4 the mean value of dose rates in all fertilizers are lower than the international limit 59 nGy h^{-1}[13] except for cy (288),nf(164) and flt(1280) . To convert the γ-ray absorbed dose to effective equivalent for workers the occupancy time (that is, for aworking period of 1820 h in a year) and a conversion factor of 0.7 Sv Gy^{-1}have been employed [14]. The calculated of annual effective dose ratevalues in all samples received by the workers of the fertilizer plants are lower than the world allowed dose of 20 mSv/y [15] and ranged from 11.78 to 681.1 mSv/y which do not cause any harm to the workers.

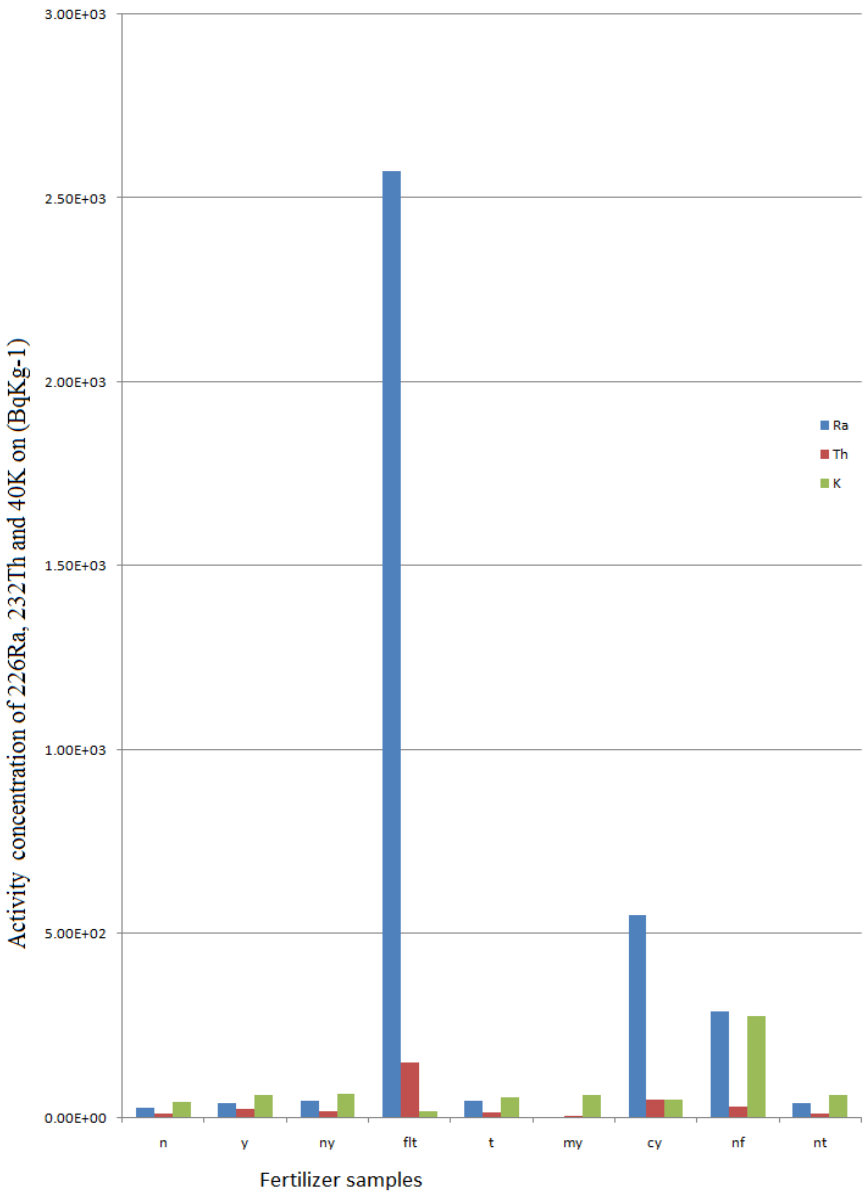

Fig. 1- The Activity Concentration of ^{226}Ra, ^{232}Th and ^{40}K in all Fertilizers samples.

Table 4. The Radiation Hazard Indices of the Samples

Sample name	Raeq (Bq kg-1)	Hex	Hin	Dose rate Do (nGyh-1)	Iγr	Annual Effective Dose DE (μSv)
AQ-U-46.5% (Y)	81.4	0.22	0.33	36.6	0.27	20.27
AQ-nU-46.5%(NY)	78.1	0.21	0.34	35.4	0.26	18.46
AQ-N-33%(N)	50.9	0.138	0.22	23.1	0.17	11.78
AQ-U-Mixed(CY)	629	1.7	3.19	288	2.11	158.28
AQ-Um(MY)	17.4	0.047	0.058	8.09	0.06	16.86
Fermexn(NF)	354	0.96	1.67	164	1.19	119.9
Tal-N-33.5%(NT)	62.6	0.17	0.2	28.6	0.21	12.06
Tal-U-46.5%(T)	75.1	0.20	0.33	34	0.25	13.79
Ssp(FLT)	2790	7.5	14.5	1280	9.33	681.1

The results for the activity of ^{226}Ra, ^{232}Th and ^{40}K (Bq kg^{-1}), of the present work compared with other studies are presented in (Table 5).

Table 5 - Comparison of mean of radioactivity concentration in fertilizers samples under investigation with those in other countries

Country	Fertilizer type	Activity (Bq kg^{-1})			Ref
		^{226}Ra	^{232}Th	^{40}K	
Qena (Egypt)	Y NY N CY MY NF NT T FLT	41.5 46 29 552 4.1 289 39.6 45.8 2570	24.5 18.8 13 51.5 5.5 30.4 12.7 17.3 150	62.1 67.3 43.9 50.4 64.2 278 62.6 57.6 19.2	Present study
Egypt (EL-Mynia)	UI PU AN SSP NK NP GF	41.4 16.7 15.5 190.7 51.7 75 47	9.1 6.7 7.3 68.3 91.2 35.5 80.5	184.7 191.5 153.8 279.8 507.5 177.3 192	[16]
Egypt (Qena)	ssp	366	66.7	4	[17]
Egypt	ssp	8.2	61	627	[18]
Pakistan	Ssp npk	556 386	49.7 38	221 885	[19] [20]
India	Ssp NPK Urea	527 79 73	7 28 202	87 1024 3	[21]
Saudi Arabia	SSP NPK	55.2 70	8.86 25	553 2700	[22]
Bangladesh	SSP	292	15.6	143	[23]

	Urea	5.4	3.4	7.9	
Algeria	NPK	162.5	124.5	8478	
USA	NPK	780	49	200	
Germany	NPK	520	15	720	
Finland	NPK	54	11	3200	
Nigeria	NPK	143	9	4729	
Brazil (Panama)	NPK	302	382	562.5	
Brazil	SSP	871	100	375	
italy	NPK	120	35	4000	

CONCLUSION

We were assessed the levels of natural radioactivity and related radiation hazards in various chemical fertilizers used in Upper Egypt by γ-ray spectrometry. The following conclusions can be obtained:

1. The activities of natural radioactivity in flt>cy>nf> y >ny> t >nt>n >my.
2. The more save chemical fertilizers for agriculture soil are urea magnesium (My), fertilizer and Ammonium nitrate (N) fertilizers.
3. In all investigated samples, the values of annual effective dose rate AED received by the workers of the fertilizer are lower than the world

allowed dose of 20 mSv/y [15]except for NF,CY and FLT and ranged from 11.78 to 681.1 mSv/y.

4. The use of fertilizers in large extent have affected radionuclides concentration, especially phosphorus and potassium containing fertilizers are the one of the cause of presence of high activity of ^{226}Ra and ^{40}K in soil. Theapplication of these fertilizers has the effect of an accumulation of radioactivity in soils that can be harmful forthe health of farmers, workers and consumers of the products.

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المخاطر البيلوجية للاشعاع الناتج عن بعض انواع الاسمدة المستخدمة فى جنوب مصر

يتعرض الفلاحين وكذلك عمال مصانع الاسمدة للاشعاع الناتج عن الاسمدة حيث انها يدخل فى تركيبها بعض العناصر مثل حجر الفوسفات والتى تحتوى على العناصر المشعة مثل اليورانيوم والثوريوم والبوتاسيوم ويمكن لهذه النويدات المشعة ان تكون سببا فى تكون اشعاع الخلفية الطبيعية

يهدف هذا البحث الى :

١- تقدير المخاطر الاشعاعية الناتجة عن استخدام الاسمدة فى المزارع

٢- تقدير نسب تركيزات النويات المشعة طبيعيا وهى نسبة تركيز الراديوم ٢٢٦ وتركيز الثوريوم ٢٣٢ وتركيز البوتاسيوم ٤٠

الخطوات

تم تجميع ٥٩ عينة من ٩ انواع من الاسمدة المستخدمه فى جنوب مصر وتم تكسير هذه العينات وطحنها وتنعيمها جيدا وتمت تعبئتها فى علب اسطوانية ذات حجم ٢٠٠ سم٣ واحكم غلقها وتم تخزينها لمدة ٣٠ يوما حتى يحدث الاتزان الاشعاعى بين الراديوم ونواتج انحلاله

وتم قياس الاشعاع الناتج عن هذه العينات باستخدام مطياف اشعة جاما المكون من كاشف الجرمانيوم النقى المتصل بمحلل عديد القنوات ١٦٠٠٠ قناة

بمعامل كلية العلوم جامعة اسيوط وقبل استخدام المطياف تمت معايرة الجهاز (Canberra, GR4020 model)بواسطة مجموعة من

المصادر المشعة مثل السيزيوم ١٣٧ والكوبلت ٦٠ labsocsوتم قياس الخلفية والصوديوم ٢٢ كما تم تقدير كفاءة الكاشف باستخدام برنامج

الاشعاعية باستخدام علبة فارغة لتصحيح معدل العد لكل عينة مقاسة

النتائج

وقد وجدت متوسط تركيزات النشاط الاشعاعى لعناصر الراديوم٢٢٦ والثوريوم ٢٣٢والبوتاسيوم ٤٠ لانواع اسمدة النترات المستخدمه فى محافظة قنا كالاتى ١١٨.٤ و٢٠و١٣٠.٥ على الترتيب ولانواع اسمدة اليوريا المستخدمه فى محافظة قنا ١٣٧.٩ و ٢٣.٥ و ٦٠.٣ على الترتيب ولسماد سوبر فوسفات ابو زعبل ٢٥٧٠ و ١٥٠ و ١٩.٢ وهى نسبة عالية لتركيز الراديوم وهو ما يؤثر بالسلب على المتعاملين مع هذا النوع وكذلك عند استخدامه فى الاراضى الزراعية