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Research Article

THE ZONING OF POTASSIUM ISOTOPE-40 IN SOILS OF AGRICULTURAL LANDS IN ARDABIL CITY

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ABSTRACT
Soil health is one of the most important issues in the production of agricultural products. The theory of Volcanic Sabalan Mountains in Ardebil and Chernvil nuclear power plant incident in natural activity has led to this study to determine the isotope potassium-40. The purpose of this study was to provide evidence for evaluation of the potassium isotope-40 in the soil of the Ardabil city. Due to the accumulation of potassium 40 in the potato farms soils and gardens, soil sampling taken from Ardabil city. Data comparison with American Idaho nuclear power plant through t-test performed in SPSS software. Results of this study showed that there are seen a rising trend in potassium-40 in the North East of Ardabil city (Niyar), but with approaching south of the city, near Shoorabil Lake, the potassium isotope-40 content decreases which in south of the city even reaches 634 kebrel per kg. The measurement results of potassium isotope-40 showed that in the all-sampling points, potassium isotope-40 content is higher than the standard of American atomic energy Idaho.

Keyword: *Radioactive Materials, Soil, Potassium 40, Ardabil*

INTRODUCTION
According to the United Nations in 1986, food security is the access of all people to enough food at all times for a healthy body. According to this definition, availability of food, accessibility to it and sustainability in food intake are three main elements (Hoghooghi, 1998). Food safety and security means ensuring that the people will use of fully and without any contamination food; this infection can be Microbial infection, parasitic and chemical.
Scientific study shows that in the last decade with the development of technology and the increasing use of additives, pesticides, antibiotics and hormones in food production in the developing countries adverse and undeniably effects has occurred on human health. This contaminations and diseases include incidence of congenital anomalies and cancers, particularly in mothers and children (Hoghooghi, 1998). Therefore, many studies conducted in order to evaluate soil contamination, but it seems that there are no studies on the human's spectral radionuclide (land materials, water, air, food) which is even naturally occur.
These Radionuclides in the environment are naturally at too low concentrations to be active (Uncear, 2000). Injuries of air in the earth's crust are natural mechanism for the release of the Radionuclides in the soil. Potassium 40 is only naturally present isotopes. Potassium 40 can enter the body through water drinking.
Potassium with nitrogen and phosphorus are main fertilizers in the fertility of soil. Potassium 40 levels in the soil, also, rise sharply using light. If potassium-40 exists in the soil, it can enter to the all plants tissue through natural and biological processes. K 40 can enter the plant through cellular damage due to ionizing radiation and can eventually cause cancer (Upton and Linsalota, 1988).
Ahadzadeh (2012), examining Ardebil soils in terms of radioactive materials, results from the measurements of Shorabil soil radiation that performed in three stages showed that although there is radioactive contamination in trace amounts in some parts of the Shorabil, but other sites are perfectly healthy from radioactive. Khodabakhsh *et al.*, (2000), in the study of nuclear radiation around the Shorabil Lake, based on the results, measurement of nuclear radiation around the Shorabil Lake showed that the spread of nuclear radiation in these territories is more than usual (about 66-30 micro-roentgen per hour). Pour *et al.*, (2011), in this study, the concentration of radon and radium in 22 river and 20 drinking water samples measured by PRASSI system. According to measurements, the average radon

concentrations in the samples were 1.122 ± 3.030 Bq/l and similarly, the average radium concentration in the whole samples obtained 0.055 ± 0.185 Bq/l. In addition, one of drinking water samples and one of rivers have higher amount of radon from 10 Bq/l, as normal level.
In the case of radium 226, radium concentration in 11 rivers and 8 drinking water samples was higher than 0.185 Bq/l, which is normal level of sum radium 226 and 228. Dadkhah and NilieAhmandi (2007), radioactive materials naturally spread throughout the environment, although they have low density and are normally harmless.

Soil naturally contains various radioactive materials some of which include uranium, thorium, radium and radon gas that continuously enters the atmosphere and have radioactivity. The major portion of the earth's crust consists of wastes with low level of radioactivity.

Radiation of these waves no due to use of uranium for power generation only, but also, extraction of uranium from mines and its primary preparation for fuel cycle in case of uranium and any kind of other elements lead to human contact to these materials.

Bayat and Ghaforian (2006), in their study showed that radioactive material is specified white – gray flower and this flower are like to dust and easily can transfer via wind and infected respiratory organs of people that located in surround of the lake.

It is obvious that origin of these dusts is, probably, a Sabalan volcanic material that fills wide parts of province lands in late tertiary and early fourth geologic era and creates Ardabil and Moghan's fertile deserts.

This volcanic product in temporal period changed to bentanit and got radioactivity properties. Riyazi and Tahghighi (2012), during occurrence nuclear events trough wars and damages to nuclear installation, most important action, primarily, is lifesaving of injured and then remove infection from infected peoples. In this text, first introduction to most important radioactive elements in terms of nuclear contaminations and then summary about what should done as primarily clinical actions for infected people has been provided. Radiation leads to biological damages to body tissues trough direct and indirect ways.

After contact of ionization rays to materials atoms, its a few or whole energy transfer and cause stimulation and ionization in site. Ionization can directly damage to structures and sensitive molecules in body cells that known as direct effect of radiation.
Badran *et al.*, (2003), the study of Cs137 nucleotides, effect of K 40 on some vegetables, reported that values of these nucleotides in diet are lower than normal level.
Because of Ardabil is one of the most important regions in production of potato and accumulation of potassium in gland products large happens, thus this study conducted to prepare for the potassium-40 in the production of gland products in this region.

MATERIALS AND METHODS

Method

This study carried out to evaluate amount of potassium isotope - 40 in Ardabil soils. Sampling, randomly, take from soil of seven regions Karshenasan, Kowsar, Niar, Niar 1, Dash kasan, Shoorabil and Shoorabil 1, in Ardabil. Data needed obtained trough sampling and analysis of samples in the laboratory of the Atomic Energy Organization of Iran.

For recording the sampling points, the location measuring device GPS is used. To prepare variables needed for related models, also, Krijing software is used.

First, collected information introduce to working pages are created in the software and then calculations conducted to achieve variables in this study. In this study, also, SPSS 20 soft ware and GIS used for data analysis. Permitted level, according to Idaho University, USA, is 400 kebrel per kilogram that used in this study.

RESULTS AND DISCUSSION

Results

Table 1: Results obtained from sampling of Ardabil soils

Sample position	Gamma spectrometer	Result	Unit
Karshenasan	Soil radio nucleotide	877 ± 33	Bq / kg
Kosar	Soil radio nucleotide	812 ± 30	Bq / kg
Niar1	Soil radio nucleotide	984 ± 37	Bq / kg
Niar2	Soil radio nucleotide	857 ± 32	Bq / kg
Dash Kasan	Soil radio nucleotide	760 ± 28	Bq / kg
Shorabil1	Soil radio nucleotide	638 ± 24	Bq / kg
Shorabil2	Soil radio nucleotide	634 ± 24	Bq / kg

According to table 1, in all sampling regions, amount of potassium isotope 40 is higher than standard level of atomic energy, 400 kebrel per kilogram, and Idaho University, USA.

Data Normality Test

To assessment normality of independent variable distribution, Kolmogorov – Smirnov test used that its assumptions are following:

Null and Alternative hypothesis:

Data distribution is normal: H0

Data distribution is abnormal: H1

Table 2: Result of Kolmogorov – Smirnov test for data normality

Parameters	Value
Maximum positive difference	0.18
Maximum negative difference	-0.15
Kolmogorov – Smirnov	0.48
Significant level	0.97

According to table 2, significant level of data is more than 5%; thus, we accept H1 assumptions. In other word, independent variable data distribution is normal.

T – Test

The aim of test is to evaluate equality of a quantity variable average to certain value. The assumption is that variable has normal distribution, which conducted by Kolmogorov – Smirnov test.

Table 3: T – test, according to Idaho university standard

Portion value: 400						
Degree of confidence		Mean difference	Standard deviation	Degree of freedom	T - test	
Highest	Lowest					
512.99	276.15	394.57	0.000	6	8.153	value

In terms of T – test analysis, in addition to Iran's Atomic Energy Organization, the results compared to standards of the University of Idaho, USA. Permitted level for isotope 40 is equal to 400 kebrel per kilogram. Results of soil sampling from Ardabil showed that highest to lowest amount of isotope 40 belongs to Niar 1 (984), Karshenasan (877), Niar 2 (857), Kowsar (812), Dash kasan (760), Shoorabil 1 (638) and Shoorabil 2 (634), kebrel per kilogram, respectively. As a result, each points of measurement represent the excess of permitted standard of Idaho University, USA. Niar (948 kebrel per kilogram) and Shoorabil (634 kebrel per kilogram) has highest and lowest infection, respectively. Table 3 shows results of T – test analysis with standard, 400 kebrel per kilogram. As seen, between measured values, soil sampling from Ardabil, is significant in 1%.

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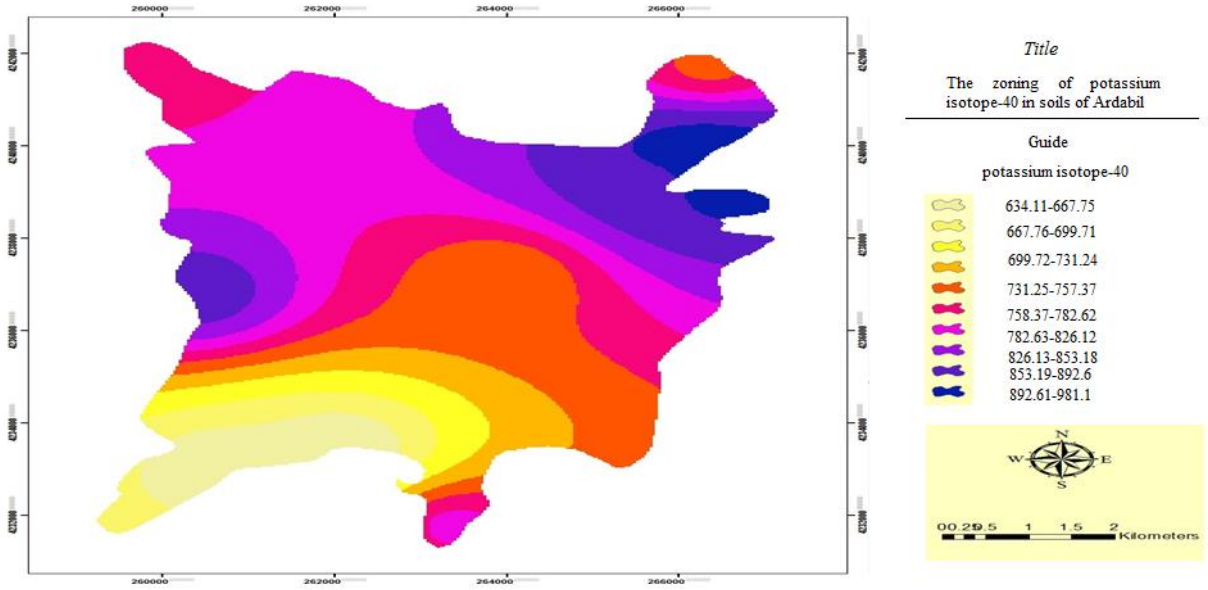

Figure 1: The zoning of potassium isotope-40

In this study, the zoning of potassium isotope-40 in Ardabil soils performed using Krijing method. According to figure 1, increasing in potassium isotope-40 in northeast of Ardabil is considerable; but with closing to south regions, Shoorabil lake, potassium isotope-40 decrease even to 634 kebrel per kilogram.

Conclusion

The aim of this study was to providing evidence for assessment of potassium isotope-40 in Ardabil soils. Results showed that measured values in sampling area were different from each other's in terms of potassium 40 concentrations. Highest and lowest amount of potassium 40 was in northeast and south of Ardabil, respectively. The results of this study shows that average concentration of potassium 40 in soils sampled from Ardabil is more than standard level of Idaho University.

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