ISSN NO. 2320-5407

*Journal homepage: http://www.journalijar.com*

*INTERNATIONAL JOURNAL OF ADVANCED RESEARCH*

**RESEARCH ARTICLE**

# Assessment of bioaccumulation radioactivity in Iraqi wheat grains

**Afaf A. Al.sabagh, Sahar A. Amin, Azhar M. Haleem**
Environmental Research Center/ University of Technology

## *Manuscript Info*

***Manuscript History:***

Received: 14 August 2014
Final Accepted: 25 September 2014
Published Online: October 2014

***Key words:***

radioactivity, wheat, grains, chemical properties.

***Corresponding Author***

**Afaf A. Al.sabagh**

## *Abstract*

Bioaccumulation radioactivity of five wheat grain varieties (three local and two imported) was investigated by using high-resolution gamma spectroscopic system employing (NaI), in addition to some chemical properties of these grains were studied. The obtained results show that (Al-Zharaʹa and Zer) brands have greatest moisture percent with mean value (9.37±0.097 and 9.19±0.188), respectively. The Zer brand recorded highest value of gluten 22.52±0.36 mg/gm.

The obtained results of the radioactivity measurements of the five wheat grains were show that the levels of radioactive materials in the studied samples are below the detection levels (BDL).



## Introduction

According to World Health Organization estimates that 70% of human food comprises cereals and legumes [1]. Wheat is the most important crop in the world. In 2010, world production of wheat was 651 million tons, making it the third most-produced cereal after maize (844 million tons) and rice (672 million tons), In Iraq 27% of farm land invests for wheat cultivation, and 33.33% of these lands located in resume watering region and 66.6% in the irrigated land [2]. There are many evidences that radioactive elements transfer from soil to plants, transfer factor (TF), this parameter is necessary for environmental transfer models which are useful in prediction of the radionuclide concentrations in agricultural crops for estimating dose intake by man [3].Natural environmental radioactivity arises mainly from natural radionuclides, such as $^{40}K$ and nuclides from $^{238}U$, $^{235}U$ and $^{232}Th$ series and their decay products which occur at trace levels in all ground formations [4]. Nuclear fission associated with atomic weapons using, manufacturing and testing provides another important source of soil contamination, the important fission fragment is $^{137}Cs$, which is strongly absorbed and retained by the soil particles and vegetations [5]. As well as production of fertilizers from natural phosphate can lead to the redistribution of uranium and other radionuclides in the environment and to increased radiation exposure. It was found that organic substances and non crystalline clay minerals were responsible for accumulation of uranium derived from fertilizers [6].

The transfer of radionuclides from farm soils to human bodies may be harmful if the maximum dose is exceeded [7 and 8]. A situation which may cause serious health problems to human beings. For example, once radionuclides accumulate in human body tissues at higher levels than the standard limit, they may cause severe health problems such as cancer. Also, when $^{226}Ra$ is deposited in bone tissue, it has a high potential for causing biological damage through continuous irradiation of human skeleton over many years and may induce bone sarcoma [9, 10 and 11]. In this framework radioactivity of three varieties of local and two imported wheat were examined using NaI gamma ray spectroscopy.

## Materials and methods:

**Sample collection:**

Three samples of local wheat (BB10, BB19 and BB20) collected from General Company of Mills, Al-Huryha warehouse beside two imported samples bought from the local markets (Zer and Al-Zahara'a) were studied. Radioactive assessment and physicochemical properties determination such as total protein, moisture, ash and wet gluten were studied for each sample.

**Moisture determination method:**

Moisture was examined according to method was cited by [12].

**Total protein determination test:**

Total protein was identified by using Coomassie Brilliant Blue G-250 method [13].

**Ash determination assay:**

Ash was measured by following method cited in [14].

**Gluten determination assay:**

Manual washing for wheat dough was followed to calculate gluten concentration [12].

**Radioactive measurement:**

The radioactivity measurements were performed by a high-resolution gamma spectroscopic system employing (NaI), while plant samples prepared according to methods cited in [15].

**Statistical analyses:**

Complete randomized block design was applied to calculate statistical differences between the different varieties of wheat by using SPSS software program at $P \leq 0.05$.

## Results and discussion:

All chemical properties for five studied wheat varieties were summarized in table (1). From results that imported wheat (Al-Zhara'a and Zer) have greatest moisture percent in mean (9.37±0.097 and 9.19±0.188) respectively with significant differences at $p \leq 0.05$, while Zer brand was record highest value of gluten 22.52±0.36 mg/gm, with significant differences in $p \leq 0.05$. In spite of its effects on wheat allergy, gluten gives the dough required elasticity, helping it rise and keeps its shape and often gives the final product a chewy texture and the wheat quality depending on gluten ratio.

**Table (1): some chemical analyses of five varieties of wheat**

| Varieties | Moisture % | Ash % | Protein mg/gm | Gluten mg/gm |
|---|---|---|---|---|
| BB10 | 7.79±0.42a | 0.39±0.06a | 1.2±0.05a | 21.42±0.88a |
| BB19 | 8.97±0.13b | 0.39±0.065a | 1.4±0.19a | 20.85±0.16b |
| BB20 | 8.79±0.21b | 0.38±0.06a | 1.07±0.165b | 21.29±0.25a |
| Zer | 9.19±0.188c | 0.68±0.03b | 1.22±0.09a | 22.52±0.36c |
| Al-Zhara'a | 9.37±0.097c | 0.603 ±0.046b | 1.4±0.19a | 21.6±0.93a |

- Each number represent Mean ± DS for triplicates.
- Different letters refer to significant differences at $p \leq 0.05$.

Radioactivity assay for five wheat varieties (flour) refers to lack of activity for all brands, this may be due to devoid of cultivated soil from radinuclides or due to its activity below the detection limits, because of the activity in the plant is concentrated in the roots and only about 1–2% was distributed in the grains, as well as that transfer factor of radionuclides from soil to plants depending on many conditions like climates, soil types and vegetation parts. The previous studies show that U was more preferable taken by the wheat roots compared to Th, because U may be more mobile in the soil and more bioavailable compared to Th [16].

1. VA Pulhan, S Dafauti, AG Hegde, RM Sharma and UC Mishra, (2003) Uptake and distribution of natural radioactivity in wheat plants from soil. Journal of Environmental Radioactivity. 79, 3, 331–346.
2. JM Sarhan, 2011 Development of strategic crops cultivation (wheat) in Iraq. Journal of Economic and Management College. 4.
3. SA Abu-khadra, MF Abdel sabour, AT Abdel Fattah and HS Eissa, 2008 Transfer Factor of Radioactive Cs and Sr from Egyptian Soils to Roots and Leafs of Wheat Plant. IX Radiation Physics and Protection Conference, 15-19 November 2008, Nasr City - Cairo, Egypt.
4. I Makiko, Yamazaki and LP Geraldo, 2003 Uranium content in phosphate fertilizer commercially produced in Brazil. Appl. Radiate and Iso.59, 133-136.
5. S Uchida, K Tagami, I Hiraj and M Komamora, 2005 Transfer factors of radionulides and stable elements from soil to rice and wheat. Radioprotection Suppl. 1, 40, 129-134.
6. WL Meserecordias, NJ Jasper, NN Karoli and AN Patrick, 2014 Environmental contamination by radionuclides and heavy metals through the application of phosphate rocks during farming and mathematical modeling of their impacts to the ecosystem. International Journal of Engineering Research and General Science .2, 4, 852-863.
7. United Nations Scientific Committee on the Effects of Atomic Radiations (UNSCEAR), 1982 Ionizing radiation: source effects and biological effects. Report to the General Assembly with Annexes 107–140.
8. NK Ahmed and GM Abdel. 2005 Natural radioactivity in farm soil and phosphate fertilizer and its environmental implications in Qena governorate, Upper Egypt. Journal of Environmental Radioactivity, 84:51-64.
9. CAST, 1986 Ionizing Energy in Food Processing and Pest Control. Report No. 109, Council for Agricultural Science and Technology, Ames,
Iowa. USA.
10. ICGFI, 1992 Radiation Safety of Gamma and Electron Irradiation Facilities. Safety Series No. 107, International Atomic Energy Agency, Vienna.
11. IAEA, 1988 Safety Factors Influencing the Acceptance of Food Irradiation Technology. IAEA TECDOC-490, International Atomic Energy Agency, Vienna.

12. American association of cereal chemists, 2000 Standard Paul Manual. USA. P 108.
13. MM Bradford, 1976 A Rapid and Sensitive Method for the Quantitation of Microgram Quantities of Protein Utilizing the Principle of Protein-Dye Binding. Analytical Biochemistry 72, 248-254.
14. World Health Organization, 1998 Quality Control Methods for Medicine and Plant Materials. Regional Office for the western Pacific. Manila.
15. I Buzas, 1993 Methods in Soil and Agrochemical Analysis in Hungarian. 1, India 4231 Kiado, Budapest.
16. LS Morton, CV Evans and GO Estes, 2002 Natural uranium and thorium distributions in podzolized soils and native blueberry. J Environ Qual, 31, 155-162.