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•*Short Report*

Transfer of ^{226}Ra and ^{137}Cs from tea leaves to drinking tea

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Background: Two of the important radionuclides which are entered to environment and human diet are radium-226 (^{226}Ra) and cesium-137 (^{137}Cs). It is clear that the methods for preparation of foods such as peeling, washing, cooking or frying can affect the dose which is received by human due the to consumption of foodstuffs. An experiment has been performed at the environmental monitoring section of NRPD, aiming to measure the transfer of ^{226}Ra and ^{137}Cs from the tea leaves to drinking part of tea. ***Materials and Methods:*** Tea samples were pulverized to obtain a homogenous matrix which was weighed and placed in 1000 cm^3 Marinelli beaker. After making tea, the liquid tea and tea-discard were analyzed separately. Measurement of ^{226}Ra and ^{137}Cs was performed by gamma spectrometry system using a high purity germanium (HPGe) detector with 40 % relative efficiency. The detector was shielded by 10 cm lead an all sides with cadmium -copper as liners. ***Results:*** It was found that the activity concentration transferred from tea leaves to drinking tea for ^{137}Cs and ^{226}Ra are less than 2% and 17% respectively. ***Conclusion:*** On the basis of these measurements it seems that no significant levels of radioactivity of ^{226}Ra and ^{137}Cs can be found in drinking part of tea. The low concentration of the mentioned radionuclides in drinking tea is mostly due to tea dust and can be removed by its washing before preparing tea. ***Iran. J. Radiat. Res., 2006; 4 (1): 49-51***

Keywords: *Radionuclides, food consumption, ^{226}Ra and ^{137}Cs, drinking tea.*

INTRODUCTION

The sources of radioactivity in the environment have both natural and man made origins. The UNSCEAR has reported that the human exposure to radiation is mainly from natural sources[1]. These sources may in turn be grouped into two distinct components, namely the sources of both terrestrial and extraterrestrial origins responsible for the external exposure, and the radionuclides taken into the human body through food, water and air particulate which give rise to the internal exposure.

Radium is one of the most important alpha emitting radionuclides in the uranium-238 decay chain, and is retained primarily in bone, due to metabolic similarities to calcium. The effective dose resulting from radium intake in normal area is found to be 3.8 $\mu Sv\ y^{-1}$ for ^{226}Ra[2]. Also, there is increasingly significant contribution from man-made sources. Two obvious examples are the Windsclae and the Chernobyl reactor accidents on 1957 and 1986.

The release of radionuclides into the environment can result in contamination of food. ^{137}Cs is intercepted directly on vegetation surfaces during dry and wet deposition in the early stage after an accident. ^{137}Cs is then transferred in to the soil with the highest soil to plant uptake in areas with high organic or sandy soils [3].

The present study was carried out to measure ^{226}Ra and ^{137}Cs activity levels in tea leave samples and drinking tea due the fact that acknowledge of the contribution of the contamination of tea leaves and process of food transfer can improve the understanding of exposure through ingestion of radionuclides.

MATERIALS AND METHODS

Ten tea samples with known concentrations of ^{226}Ra and ^{137}Cs from International Atomic Energy Agency (IAEA) were used in this research. After making tea

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(three hundred grams of tea in one liter of water), the liquid tea and tea-discard were placed in 1000 cm^3 Marinelli beaker and 300 gram plastic container respectively, and were analyzed separately.

Measurements were carried out on sealed samples, after aging time of at least 21 days in order to allow the establishment of radioactive equilibrium between radium and its short- lived daughter products. The measurement of ^{226}Ra and ^{137}Cs was performed by gamma spectrometry system; using a CANBERRA high purity germanium (HPGe) detector with 40% relative efficiency. The detector was shielded by 10 cm lead from all sides with cadmium -copper as liners. Figure 1 shows the detector shield for gamma spectrometry. The system was equipped with soft ware for data acquisition and analyzing. The counting time was 60,000 seconds and background spectra was also collected for the same period of time and subtracted from samples spectra. Marinelli standard mixed source (CERCA HM 395) from France was used for efficiency calibration due to its close geometry to the sample geometry.

The ^{226}Ra activity was determined via gamma line of its daughter product, ^{214}Bi (609 keV) and for ^{137}Cs the gamma line of 661 keV was used.



Figure 1. Gamma spectrometry detector shield.

RESULTS AND CONCLUSION

Data analysis performed by dividing data per tea leaves, drinking tea and discarded tea. Then, we compared the results obtained on the same sample for the same treatment. Every sample was measured for 60k seconds and then activity concentrations of ^{226}Ra and ^{137}Cs were determined by gamma spectrometry system.

The average values along with maximum and minimum values of the measured activities are shown in Table1. The variation in the activity of ^{226}Ra in tea leaves is within 10% of their average value. However, in cases of ^{137}Cs the maximum deviation from the average is about 3%.

Table 1. Activity concentration of tea samples by gamma spectrometry (mBq $sample^{-1}$).

sample	^{226}Ra (max.-min.) mean±1δ	^{137}Cs (max.-min.) mean±1δ
tea leaves	(617-510) 563 ± 51	(2572-2460) 2510 ± 93
drinking tea	(116-77) 96 ± 17	(75-46) 60 ± 11
discarded tea	(533-429) 482 ± 50	(2464-2270) 2432 ± 88

The ratios of the activities of ^{226}Ra and ^{137}Cs in discarded tea to tea leaves were determined. These ratios are about 86% and 98% for ^{226}Ra and ^{137}Cs, respectively.

As it is seen from table 1 the activity values for ^{226}Ra and ^{137}Cs in drinking tea samples are not comparable with tea leaves. Therefore, based on these data significant fractions of ^{226}Ra and ^{137}Cs concentrations in leaves remain in discarded tea.

On the basis of these measurements it seems that no significant levels of radioactivity of ^{226}Ra and ^{137}Cs can be found in drinking tea. The low concentrations of mentioned radionuclides in drinking tea is mostly due to tea dust and can be removed by its washing before preparing tea.

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REFERENCES

1. UNSCEAR (1993) Sources and effects of ionizing radiation. United Nations scientific committee on the effect of atomic radiation, Vol 1: United Nations, New York.
2. Malanca A, Gazzola A, Santos ZL (1998) Intake of radium and effective dose for the population of Brazilian state. *The Nucleus,* ***35:*** *127-131.*
3. Badran HM, Shaeshar T, Elminar T (2003) Levels of ^{137}Cs and ^{40}K in edible parts of some vegetables consumed in Egypt. *Journal of Environmental Radioactivity,* ***67:*** *181-190.*
4. Banzi PF, Kifango LD, Bundale FM (2000) Natural radioactivity and radiation exposure at the Minjingu phosphate mine in Tanzania. *J Radiat Prot,* ***20:*** *41-51.*

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