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Natural radioactivity of some local and imported fertilizers in Basrah Governorate/Iraq

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ABSTRACT

The naturally occurring activity concentration of radionuclides ^{226}Ra, ^{232}Th, ^{228}Ra, ^{238}U and ^{40}K has been measured in different types of fertilizer samples used in Basrah Governorate using sodium iodide NaI(Tl) gamma spectrometry. The results of measurements showed that the mean value and range of specific activities for ^{226}Ra, ^{232}Th and ^{40}K activities in the nitrogen, phosphorus and potassium fertilizers are 107.0±8.7 Bq/kg (8.6 - 410), 108.0±7.6 Bq/kg (4.1 - 397.5) and 1207.0±9.8Bq/kg (201.2 - 4237.7) Bq/kg, respectively. The maximum radium activity found in Crop Complex fertilizer with respect to organic fertilizers under investigation. Radium equivalent activity exceeds 370 Bq/kg, in some samples, the maximum permissible limit for radiation dose for all present samples. This study could be useful as baseline data for radiation exposure to fertilizers and their impact on human health.

Keywords: Natural radioactivity, Fertilizers, Gamma Spectroscopy, NaI(Tl)

INTRODUCTION

The exposure of the public to natural radioactivity has been estimated by the UNSCAR, which concluded an effective average annual dose equivalent to 2.4 mSv/y per individual [1-3]. Natural radioactivity arises mainly from the primordial radionuclides, such as ^{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 [4]. This natural radioactivity in soil may vary considerably from one type to other. In soil, one source of radioactivity other than those of natural origin is mainly due to extensive use of fertilizer which is rich in phosphate and accordingly the radioactive ^{40}K used for agricultural purpose [5]. The knowledge of specific activities or concentrations and distributions of the radionuclides in these fertilizers are of interest since it provides useful information in the monitoring of environment radioactivity. Gamma radiation emitted from fertilizers represents one of the main external source of irradiation of the human body. The fertilizers added to soil in order to reach high agriculture productivity, for example adding the NPK to the soil replace the nutrients in soils [6] . Only nuclides with half-lives comparable with the age of the earth or their corresponding decay products, existing in terrestrial materials, such as ^{40}K, ^{238}U and ^{232}Th are of great interest. Abnormal occurrences of uranium and its decay products in ore rocks and fertilizer are the main sources of high natural background areas that have been identified in several areas of the world [7]. From the point of view of the international Atomic Energy Agency of radio nuclides in food and environment IAEA(8), it is necessary to estimate the dose limits of occupier exposures and to measure the natural environmental radiation level provided by ground , air, water, fertilizer etc. for estimation of the exposure to natural radiation sources. The UNCEAR, 1993[9] estimated the general range of ^{238}U is 37- 4900 Bq/kg and for ^{226}Ra a range of 100 - 10,000 Bq/kg in different