*Ain Shams University*
*Women's College for Arts,*
*Science and Education*
*Physics Department*

# EVALUATION OF NATURAL RADIONUCLIDES AND ELEMENTAL ANALYSIS OF DIFFERENT KINDS OF FERTILIZER USING DIFFERENT TECHNIQUES

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**By**

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*Ain Shams University*
*Women's College for Arts,*
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**A Thesis for M.Sc. in Physics**

**Amira Adel Shenoda Nasr**

## Title of Thesis

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*Amira Adel*

# ABSTRACT

The main target of this study is to make a comparison between different kinds of fertilizers by measure the concentration of natural radionuclide's, heavy metals and toxic substances, using different techniques.

First, The concentration of the natural radionuclides are measured in all the studying samples to find the specific radioactivity of $^{238}$U-series, $^{232}$Th-series and $^{40}$K by using a high resolution gamma ray spectrometer based on coaxial HPGe detector shielded by cylinders of lead, copper and cadmium. The analysis of data is completed by using a computerized analyzer fitted with a high multichannel analyzer with high level software programs.

Fourteen samples of fertilizer were collected from different places in Egypt markets and industries.

Calculate the radiological parameters (Radium equivalent activity $Ra_{eq}$, Radiation level index, External hazard index $H_{ex}$, Internal hazard index $H_{in}$, Absorbed dose rate $D_R$ and Effective dose $E_{eff}$) to make a comparison with the permissible international level.

The results of concentration levels are compared with similar studies carried out in other countries.

The mean activity concentrations of $^{238}$U, $^{232}$Th, $^{226}$Ra and $^{40}$K for studied fertilizer samples has been observed to ranged from (9.67 to 562.10), (11.02 to 362.29), (33.41 to 1162.39) and (92.65 to 17162.88) Bq/Kg for $^{238}$U, $^{232}$Th , $^{226}$Ra and $^{40}$K respectively.

The permissible activity levels for fertilizers are 50, 50 and 500 Bq/kg for $^{226}Ra$, $^{232}Th$ and $^{40}K$ respectively as a soil but for super phosphate (SSP) and potash (PF) fertilizer are 1000, 1000 and 4000 Bq/kg for $^{226}Ra$, $^{232}Th$ and $^{40}K$ respectively **(UNSCEAR, 2000 and El-Taher & Mohamed Anwar Abdelhalim, 2013).**

The concentration values of $^{226}Ra$ are lower than the permissible level except samples F2, F5, F10 and F11 but for SSP and PF are lower than permissible level except F6. The concentration values of $^{232}Th$ in all studied samples are lower than the permissible level. Also, the concentration of $^{40}K$ are lower than permissible level except samples F1, F3, F10 and F11 but for SSP and PF are lower than permissible level except F4, F9.

The values of radium equivalent of the samples vary between (42.54 to 1918.91) Bq/Kg. These values are lower than the recommended maximum value 370 Bq/Kg **(Singh et al., 2005 and Huy & Luyen, 2006)** except (F1, F4, F6, F9 and F10) samples.

The value of radioactivity level index Iγ vary between (0.34 and 14.22). These values are found to be less than unity except (F1, F3, F4, F6, F9, F10 and F11) samples.

The value of average external hazard index and average internal hazard index vary between (0.17 to 5.18) for $H_{ex}$, (0.26 to 6.44) for $H_{in}$. It is found to be less than unity except (F1, F4, F6, F9, F10 and F11) samples.

Also we note that the average values of dose rate for samples vary between (15.41 to 826.16) nGy/h. These values are lower than the international average mean value 59 nGy/h **(UNSCEAR, 2000)** except samples (F1, F3, F4, F6, F9, F10 and F11).

While, the values of the effective dose rate for samples vary between (0.01 to 1.01) mSv/y. These values are lower than the permissible limit "1mSv/y" that recommended by the International Commission Radiological Protection as the maximum annual dose to the public members except sample F9.

We noticed that there are a good correlation between ($^{238}U$ to $^{226}Ra$), which clear the equilibrium in the uranium series. Also there are a good correlation between ($^{238}U$ and $^{232}Th$), while there is a poor correlation between ($^{232}Th$ and $^{40}K$) and ($^{238}U$ and $^{40}K$).

The radon exhalation rates for samples are also calculated. The values of emanation factor (F) ranges from 0.31 to 0.81, emanation coefficient of Radon $A_{Rn}$ ranged from (10.33 to 662.20) Bq/Kg and Radon mass exhalation rate $E_{Rn}$ are ranged from (0.72 to 1616.46) mBq/Kg sec. The highest value of $E_{Rn}$ was found in sample F6 which also has the highest $^{226}Ra$ activity.

Second, determination of heavy metals and toxic elements (Cd, Cu, Fe, Mg, Mn, Ni, Pb and Zn) using Flam Atomic Absorption Technique (FAAS).

The results show that contents of heavy metals varied significantly in different types of fertilizers like; single super phosphate (SSP), potash fertilizer (PF), zinc-sulfate ($ZnSo_4$), urea (URA), organic fertilizer (OF), nitrogen fertilizer (NF) and nitrogen phosphorus potassium(NPK) depending on NPK ratio and fertilizer origin.

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