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Using Numerical Methods and Graph Theory for Developing Mathematical Models to Estimate Uranium Concentrations

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ABSTRACT

The research aims to build sports models to find the concentration of uranium in herbs using twelve herbs from medicinal herbs various uses by human use crime methods theory definition and some numerical methods different like Novel and Hermitian where we got mathematical models implicitly through it effect amount uranium herbs, and we got on miniatures mistake percentage almost non-existent.

MSC..

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1. Introduction

The Human beings have been exposed to natural radiation since the world has been radioactive since its formation. Radiation is defined as the energy emitted by radioactive nuclei when they return to a stable state and is divided into two as ionizing and non-ionizing radiation in terms of its effect. Ionizing radiation from natural sources can damage living things when it gets into cells [1].

Radiation is irradiated by natural sources such as cosmic rays from outer space and the sun, and radioisotopes found in the earth crust. The most important component of the radiation dose received from natural sources is radon gas and its short-half-life decay products. The dose exposed due to radon gas has a share of 50%, and the annual dose is approximately 1.3 mm/second. Depending on the geographical conditions, living standards, and

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physical characteristics of the environment in which they live, people are exposed to an average annual natural radiation dose of 2.4 mm/second [2].

Radon is colorless, odorless, tasteless, about eight times heavier than air, and is found in soil, air, grass, plants and aquatic species which is created whenever uranium decomposes. It is also found in groundwater due to the dissolution of soil and rocks in contact with water. Furthermore, gas diffusion from rocks and soil into well water is affected by water level, aeration, and other physical factors [3]. Radon has a half-life of 1600 years which is formed as a result of Radium-226 (^{226}Ra) releasing alpha. Although there are many isotopes, the isotopes known to increase the amount of radiation in the environment the most are thoron Radon-220 (^{220}Rn) and actinon Radon-219 (^{219}Rn). The half-lives of radon are very short, 55.1second and 3.96 second, respectively. Therefore, the element radon has a half-life of 3.82 days [4].

The amount of radon released into the environment depends on meteorological conditions, time, and altitude. With the low atmospheric pressure, the pressure in the ground air is also low. There is an increase in radon migration due to the decrease in radon migration. In rainy weather, the soil pores are closed as the soil is moistened, and the radon density on the soil surface decreases as radon diffusion becomes difficult. As the temperature drops, the pores will open with the drying of the soil, making it easier for radon to escape from the soil [1]. Due to its short half-life, the amount of radon in the air changes with the seasons based on the altitude above sea level. As the altitude goes up, the amount of radon in the air steadily goes down [4].

This gas spreads into the environment in close relation with the geological structure of the geographical region. Granite, volcanic soils, and sedimentary schists are important sources of radon. Sedimentary soils have a low radon concentration. uranium and radon are also found in some chalk deposits, albeit in small amounts. Radon can also be released in small amounts by groundwater, natural gases, coal, and the oceans [5-7].

Herbs is one of the most important elements necessary for living things to survive. For this reason, the herbs used by living things should not pose a health risk. The grass contains natural radioactive elements that are harmful to health in terms of radiation, so this is a very important issue for animal health and human public health [6]. The naturally radioactive radon is the biggest cause of the radiation dose that people and animals are exposed to by using their eating grass [8-11]. People think that getting radiation from radon and its products with short half-lives raises the risk of cancer [12].

Knowing the radon level of the investigated region and following the changes in this level are of great importance in order to determine the dose that animals and people living in that area are exposed to and to take precautions when necessary.

2. Field of Application

The study depends on the mathematical modelling process using methods graph theory and numerical methods like Hermitian to perform concentration calculations uranium in herbs so in search it was completed creating the mathematical modelling through accreditation on methods graph theory like Hermitian.

3. Neville's Method

The main idea of Neville's method is to approximate the value of a polynomial at a particular point without having to first find all of the coefficients of the polynomial. The Neville method can be defined as follows: Let f be a function whose values at the n points $X_0, X_1 \ldots X_n$ is known [13]. Let $\{m_1, m_2, \ldots m_k\}$ be a set of k distinct integers from the set $(0, 1.2, \ldots. n\}$. Let $Pm_1, m_2 \ldots m_k (x)$ stand for the Lagrange polynomial that agrees with the function f at the k points $xm_1, xm_2, \ldots xm_k$, …. i.e. $Pm_1, m_2, \ldots, m_k (xm_1) = f(m_1), Pm_1. M_2,\ldots m_k (xm_2) = f(xm_2),\ldots, Pm_1. M_2\ldots m_k (xm_k) = f(xm_k)$. Naturally, $Pm_1, m_2,\ldots, m_k (x)$ is the only polynomial of degree (k- 1) that passes through the k points $(xm_1 . f(xm_1)),\ldots, (xm_k . f(xm_k))$. Neville's method idea is to recursively use Lagrange polynomials of lower powers to compute Lagrange polynomials of higher power relationships. This is useful; for example, if you have the Lagrange polynomial based on some set of data points $(xi, f(xk)), k= 0, 1,\ldots,n,$ and you get a new data point, $(xn+1, f(xn+1))$.

$$R_k = \frac{(N - N_0)R_{K_1} - (N - N_1)R_{K_0}}{N_1 - N_0},$$

$$N_0 = 7573.9 \qquad R_{K_0} = 0.235$$

$$R_K = \frac{(N - 7573.3)(0.552) - (N - 18284.0)(0.235)}{18284.0 - 7573.9}$$

$$= \frac{0.552\,N - 4180.7928 - 0.235\,N + 4296.74}{10710.1}$$

$$= \frac{0.317\,N + 115.9472}{10710.1}$$

$$= 0.0000296\,N + 0.010825 \qquad (1)$$

TABLE 1: CALCULATE URANIUM CONCENTRATION IN THE GRASS USING THE NEVILLE METHOD

No.	Grass name	V_1	R_K EXP	R_K Det	E	E^2
1	Dill	7573.9	0.235	0.235	0.000	0.000
2	Chamomile	7662.7	0.238	0.237	0.001	0.000001
3	Poot nut	7692.3	0.239	0.238	0.001	0.000001
4	Slanderous	8402.3	0.261	0.259	0.002	0.0000004
5	Ginger	9112.4	0.283	0.280	0.003	0.000009
6	Carway	10887.2	0.338	0.333	0.005	0.0000025
7	Gray roses	11094.6	0.345	0.339	0.006	0.000016
8	Rose mary	13195.7	0.410	0.401	0.009	0.000081
9	Tablet	13520.7	0.420	0.411	0.009	0.000081
10	Snack	14349.1	0.446	0.435	0.011	0.000121
11	Sweet pill	14408.2	0.448	0.437	0.011	0.000121
12	Zamand	18284.0	0.552	0.552	0.000	0.000
	∑					0.000498

The figure of estimated and real values for the potassium radiation effect on the soil by using Neville's method is as follows:

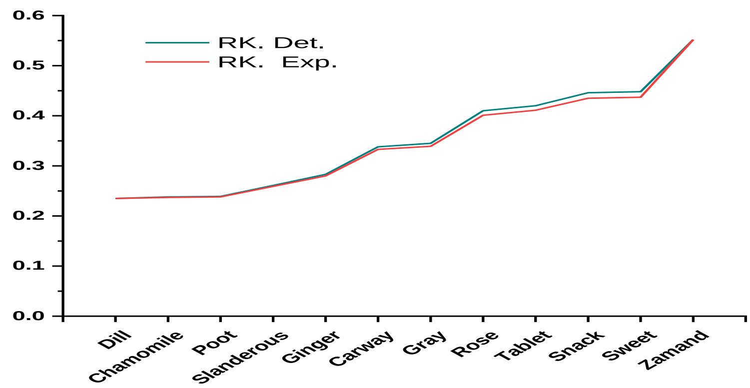


FIGURE 1 THE GRAPH OF REAL AND ESTIMATED VALUES FOR THE EFFECT OF POTASSIUM RADIATION ON SOIL USING NEVILLE'S METHOD

4. Hermit Method

To estimate by using Hermite method, we will estimate the potassium radiation amount on soil in the governorate of Nineveh, where N is the net area under photovoltaic peak of kama energy used for measurement in the spectrum and Rk is the radiation effect. Using Hermite's method, the rule can be written as follows [14]:

N0 = 1200 , F (N0) = 323.8

N1 = 1359 , F (N1) = 366.7

N2 = 1370 , F (N2) = 369.7

N3 = 1405 , F (N3) = 379.1

N0= 7573.9 N1=7662.7 , F (N0) =0.235

N2 = 7692.3 N3 =8402.3 , F (N1) = 0.238

F (N2)=0.239

F (N3)=0.261

$$F[N_0, N_1] = \frac{F(N1) - F(N0)}{N1 - N0}$$

$$= \frac{0.238 - 0.235}{7662.7 - 7573.9} = \frac{0.0033}{88.8} = 0.000033$$

$$F[N_1, N_2] = \frac{F(N2) - F(N1)}{N2 - N1}$$

$$= \frac{0.239 - 0.238}{7692.3 - 7662.7}$$

$$= \frac{0.001}{29.6} = 0.000033$$

$$F[N_2, N_3] = \frac{F(N3) - F(N2)}{N3 - N2}$$

$$= \frac{0.261 - 0.239}{8402.3 - 7692.3}$$

$$= \frac{0.022}{710} = 0.000033$$

$$F[N_0, N_1, N_2] = \frac{F[N1,N2] - F[N0,N1]}{N2-N0}$$

$$= \frac{0.000033-0.000033}{7692.3-7573.9} = \frac{0}{118.4} = 0$$

$$F[N_1, N_2, N_3] = \frac{F[N2,N3] - F[N1,N2]}{N3-N1}$$

$$= \frac{0.000033-0.000033}{7692.3-7662.7} = \frac{0}{29.6} = 0$$

$$F[N_0, N_1, N_2, N_3] = \frac{F[N1,N2,N3] - F[N0,N1,N2]}{N3-N0}$$

$$= \frac{0-0}{8402.3-7573.9} = \frac{0}{828.4} = 0$$

$$R_K = F[N0] + F[N_0, N_1](N - N_0) + F[N_0, N_1, N_2](N - N_0)(N - N_1) + F[N_0, N_1, N_2, N_3](N - N_0)(N - N_1)(N - N_2)$$

$$= 0.235 + 0.000033\,(N-7573.9) + 0 + 0$$

$$= 0.235 + 0.0000337N - 0.24993$$

$$= 0.000033N - 0.01493 \qquad (2)$$

TABLE 2: CALCULATE URANIUM CONCENTRATION IN GRASS USING HERMIT METHOD

No.	Grass name	N	Exp C(N)	R_K Det	R_K Det E	E^2
1	Dill	7573.9	0.235	0.2350	0.000	0.000
2	Chamomile	7662.7	0.238	0.237	0.001	0.000001
3	Poot nut	7692.3	0.239	0.238	0.001	0.000001
4	Slanderous	8402.3	0.261	0.262	0.001	0.000001
5	Ginger	9112.4	0.283	0.285	0.002	0.000004
6	Carway	10887.5	0.338	0.344	0.006	0.0000036
7	Gray roses	11094.6	0.345	0.351	0.006	0.000036
8	Rose mary	13195.2	0.410	0.420	0.011	0.000121
9	Tablet	13520.7	0.420	0.431	0.011	0.000121
10	Snack	14349.1	0.446	0.458	0.012	0.000144
11	Sweet pill	14408.2	0.448	0.460	0.012	0.000144
12	Zamand	18284.0	0.552	0.588	0.036	0.00129
	∑					0.001868

The figure of real and estimated values for the effect of potassium radiation on soil using Neville's method.

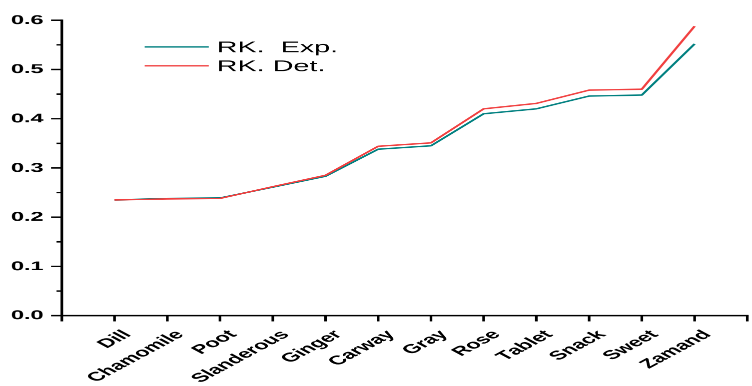


FIGURE 2 THE GRAPH OF ESTIMATED AND REAL VALUES FOR POTASSIUM RADIATION EFFECT ON THE SOIL BY USING NEVILLE'S METHOD

5. Graph Theory

Graph theory is "the study of points and lines. In particular, it involves the ways in which sets of points, called vertices, can be connected by lines or arcs, called edges". Graphs in this context differ from the more familiar coordinate plots that portray mathematical relations and functions The Graph theory can be defined as two groups, the first is a set of

nodes V the second is a set of ribs E, and we call the arranged duo G(V.E) graph whereas V={V, V2, V3,..}, E={E, E2, E3...). We note that each side connects two nodes of the graph.

$$\frac{(\mathrm{N}-\mathrm{N}_1)\,\mathrm{R}_{\mathrm{K}12}-(\mathrm{N}-\mathrm{N}_{11})\mathrm{R}_{\mathrm{K}1}}{\mathrm{N}_{11}-\mathrm{N}_1}$$

N1=7573.9 , RK12=0.235

N11=14408.2 , R_{K1}= 0.552

$$\frac{(\mathrm{N}-7573.9)\,0.552-(\mathrm{N}-14408.)0.235}{14408.2-7573.9}$$

$$=\frac{0.552\,N-4180.7928-0.235\,N+3385.927}{6834.3}$$

$$=\frac{0.317N}{6834.3}-\frac{794.8658}{6834.3}$$

$$= 0.000046\mathrm{N} - 0.11630 \qquad (3)$$

No	Grass name	N	R_K EXP	R_K DET	E	$(E)^2$
1	Dill	7573.9	0.235	0.232	0.003	0.000009
2	Chamomile	7662.7	0.238	0.236	0.002	0.000004
3	Poot nut	7692.3	0.239	0.237	0.002	0.000004
4	Slanderous	8402.3	0.261	0.270	0.009	0.000081
5	Ginger	9112.4	0.283	0.302	0.019	0.000361
6	Carway	10887.5	0.338	0.384	0.046	0.002116
7	Gray roses	11094.6	0.345	0.394	0.049	0.002401
8	Rose mary	13195.2	0.410	0.490	0.08	0.0064
9	Tablet	13520.7	0.420	0.505	0.085	0.007225
10	Snack	14349.1	0.440	0.543	0.097	0.009409
11	Sweet pill	14408.2	0.448	0.546	0.098	0.009604
12	Zamand	18284.0	0.552	0.724	0.172	0.02958
	$\sum$					0.067194

The figure of real and estimated values for the effect of potassium radiation on soil using Graph Theory

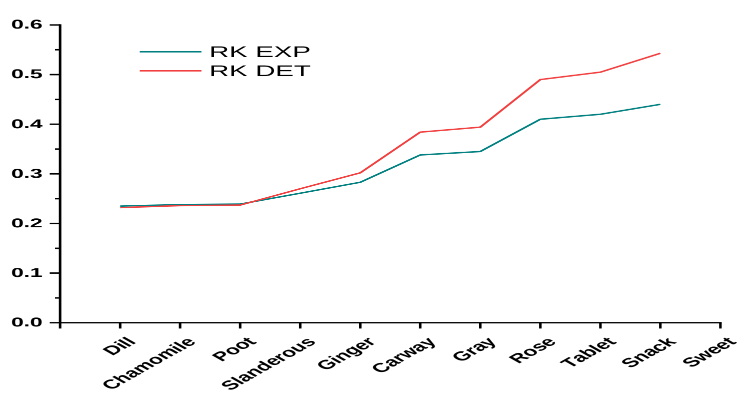
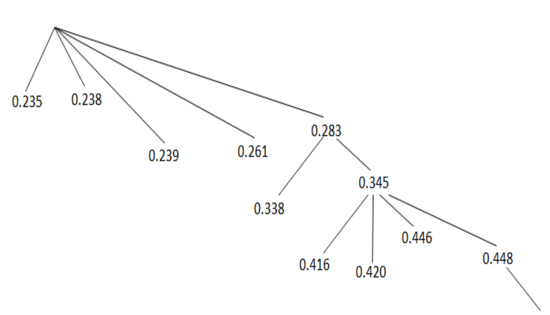


FIGURE 3 THE GRAPH OF REAL AND ESTIMATED VALUES FOR THE EFFECT OF POTASSIUM RADIATION ON SOIL USING GRAPH THEORY



FLOWCHART 1

5. Conclusion

Since the creation of the Earth, organic radionuclides have been in plants, water, herbs, rocks, soil, and air. Due to the extremely long deterioration half-lives (hundreds of millions of years or longer) of some of these radionuclides, large quantities of these isotopes are still on Earth presently. Plants and herbs absorb radionuclides from the soil, making them accessible for further dissemination such as direct human consumption or indirect animal consumption. Radiopharmaceutical concentrations in plants vary and are affected by a variety of variables.

As a consequence of the decay of uranium and thorium, other naturally occurring radioisotopes are discovered in lesser amounts. Radon is a very important radioisotope for health sciences because it is so widely spread in the air and in living things. This makes it the biggest source of the dose that people get.

As shown by a short investigation measuring the radon concentration in multiple herbs, the thesis demonstrated that mathematical modeling is an accurate and effective method for determining uranium radon in various herbs. This research demonstrated a relationship between mathematics and healthcare by using graph theory and numerical analytic techniques. We do not construct mathematical models that help us solve issues; instead, we gain answers that are compatible with experimental evidence and theoretical values via the use of these models. Previous outcomes: We have employed extrapolation techniques by using the Neville, Leas Square, and Hermit methods to validate the mathematical models given.

The mathematical models presented in this research have proved to be effective and useful tools. Consequently, the suggested models produced results that were faultless and consistent. The mathematical models derived from the four ways assisted us in estimating the radon and uranium concentrations in various plants. The best models were found to be those developed by numerical analysis, which is the approach of Neville in the second chapter of uranium, as well as the methods of Hermit and least squares. Regarding the third chapter on radon, it was determined that the Neville approach is superior to least squares and Hermit. Comparing radon and uranium, they discovered that Neville is the superior way, while Krav's Theory provided results in the first example for uranium but not for radon.

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