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CREATION OF MATHEMATICAL MODELS USING GRAPH WITH NUMERICAL METHODS

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Abstract. The purpose of the present study was to determine the concentrations of radioactivity from Pb^{210} and Pb^{214} isotopes in wheat and crops. 10 samples of wheat and 12 samples of potatoes were collected where estimated radioactivity concentration is Pb^{210} . We have applied two methods; the first method is used to create a numerical model that calculates the concentration of radioactive lead in both potato and wheat crops. The second method is utilized to construct a model with graphics to calculate the lead radioactivity in wheat, potatoes, and use. Finally, the results of the two models have been compared to get the best results to reduce the radioactivity of the crops.

Keywords: concentration, radioactivity, numerical method, graph.
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1 Introduction

Many countries of the world and international organizations are interested in conducting studies related to finding concentrations of radioactivity for radioactive elements such as Th^{232}, Pb^{214}, Pb^{210}, Po^{210}, Po^{214}, Rn^{222}, and Ra^{226} in several kinds of food like red meat, chicken, fish, wheat, rice, milk, vegetables, fruits, and more (Avadhani et al., 2001; Al-Masri et al., 2004; Hosseini et al., 2006; Sugiyama et al., 2007) and (Ladygiene, 2008). The studies of many researchers have proven that the concentration of lead in fish is higher than that in milk, wheat and all vegetables. Theoretical ideas have used graph in computer science applications such as data extraction, image segmentation, grouping, image capture, networks, etc. As an example, the data structure can be designed in the form of a tree that in turn uses heads and edges. Likewise modeling network topology can be done using graph concepts (Liu et al., 2008) and (Dharwadker & Pirzada, 2007). In the same way the most important concept for graph coloring used for resource allocation and scheduling. Additionally, the tracks, bios, and circuits in graph theory are used in enormous (Avadhani et al., 2001) and (Balakrishnan & Ranganathan, 2000). Database design concepts and resource networks lead to the development of new algorithms and new theories that can be used in massive applications (Schenker et al., 2007) and (Dharwadker & Pirzada, 2008).

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Dharwadker & Pirzada, 2008) and (Diestel, 2000). In the same way the most important concept for graph coloring used for resource allocation and scheduling. Also, the tracks, bios, and circuits in graph theory are used in enormous (Liu et al., 2008) and (Dharwadker & Pirzada, 2007). Database design concepts, resource networks. this leads to the development of new algorithms and new theories that can be used in massive applications (Schenker et al., 2007) and (Dharwadker & Pirzada, 2008)

2 Creating a numerical model to determine the percentage of radiation in the potato and wheat

In this section we are going to apply the numerical method to find the concentration radiation in the potato and wheat as shown in coming two tables.

2.1 The Formula of Concentration

First, we are going to formulate the numerical formula of concentration of lead radioactivity pb^{210} in potatoes as follows:

The formula of concentration of lead radioactivity pb^{210} in potatoes

$$N = n_0 + \frac{(n_1 - n_0)}{(m_1 - m_0)}(m - m_0)$$

where m refers to annual dose concentration of lead radioactivity pb^{210} in wet sample, n is the sample then

$$\begin{aligned}
m_0 &= 1.12 \qquad n_0 = 0.0907 \\
m_1 &= 1.32 \qquad n_1 = 0.1064 \\
n &= 0.0907 + \frac{(0.1064 - 0.0907)}{(1.32 - 1.12)}(m - 1.12) \\
&= 0.0907 + \frac{0.0164}{0.2}(m - 1.12) \\
&= 0.0907 + 0.082(m - 1.12) \\
&= 0.0907 + 0.082m - 0.09184 \\
&= -0.00114 + 0.082m
\end{aligned}$$

Remark 1. *In Table 1, we find that the error rate is small, which means that the radiation level in potatoes crop can be determined more accurately.*

Now, we give the numerical formula of concentration of lead radioactivity Pb^{210} in wheat.

2.2 The Formula of Concentration

The formula of concentration of radioactive lead Pb^{210} in wheat M = annual dose concentration of lead radioactivity Pb^{210} in wet samples = N.

Table 1: Determining n via the m and comparing them with the obtained experimental values

No.	m	$nExp.$	$nDet.$	$Error$
1	1.12	0.0907	0.0907	0.000
2	1.32	0.1064	0.1071	0.0007
3	1.8	0.1456	0.1464	0.008
4	2.13	0.172	0.173	0.001
5	2.23	0.1796	0.1817	0.0021
6	2.48	0.2004	0.2022	0.0018
7	3.02	0.243	0.246	0.0035
8	3.64	0.2938	0.2973	0.0035
9	4.12	0.3319	0.3367	0.0048
10	10.07	0.8114	0.8246	0.0132

Then this equation:

$$
\begin{aligned}
N =& n_0 + \frac{(n_1 - n_0)}{(m_1 - m_0)}(M - m_0) \\
m_0 =& 61.25 \qquad n_0 = 0.0635 \\
m_1 =& 62.50 \qquad n_1 = 0.648 \\
M =& 0.635 + \frac{(0.648 - 0.635)}{(62.50 - 61.25)}(x - 61.25) \\
=& 0.635 + \frac{0.013}{1.25}(M - 61.25) \\
=& 0.635 + 0.0104(M - 61.25) \\
=& 0.635 + 0.0104M - 0.637 \\
=& -0.002 + 0.0104M
\end{aligned}
$$

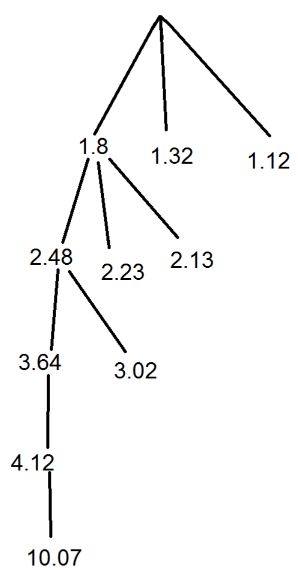

Figure 1: h via the j and comparing them with the obtained experimental values using graph theory

Table 2: Determining n via the m and comparing them with the obtained experimental values

No.	m	$nExp.$	$nDet.$	$\|mExp. - nDet\|.$
1	61.25	0.635	0.635	0.000
2	62.50	0.648	0.648	0.000
3	64.82	0.672	0.672	0.000
4	65.3	0.677	0.677	0.000
5	69.25	0.718	0.718	0.000
6	69.48	0.710	0.720	0.010
7	70.6	0.732	0.732	0.000
8	101.96	1.057	1.057	0.001
9	103.76	1.076	1077	0.001
10	113.05	1.127	1.173	0.001
11	138.61	1.437	1.439	0.002
12	176.04	1.825	1.828	0.003

Remark 2. *In Table 2, we find that the error rate is small, which means that the radiation level in wheat crop can be determined more accurately.*

3 Constructing a graph model to determine the percentage of radiation in the potato and wheat

In this section we introduce graph method for table (1) and table (2)

3.1 The formula of concentration of lead radioactivity Pb^{210} in potatoes

The formula of concentration of lead radioactivity Pb^{210} in potatoes is formed as following:

$$S_v(J) = \frac{(J - J_{v1})h_{10} - (J - J_{v9})h_1}{(J_{10} - J_2)}$$

where J is unknown edge in graph and j_{v9} is first edges, while h refers to vertices of the experiment.

$$\begin{aligned}
&= \frac{(J - 1.12)0.81114 - (J - 4.12)0.0907}{(10.07 - 1.32)} \\
&= \frac{0.81114J - 0.908768 - 0.0907J + 0.373684}{8.75} \\
&= \frac{0.7207J - 0.535084}{8.75} \\
&= 0.08714631J - 0.06470181
\end{aligned}$$

This moment, we are applying the graph method to the same samples in wheat.

3.2 The formula of concentration of lead radioactivity Pb^{210} in wheat

The formula of concentration of lead radioactivity Pb^{210} in wheat is formed as follows:

$$S_v(J) = \frac{(J - J_{v1})h_{12} - (J - J_{v11})h_1}{(J_{12} - J_2)}$$

Table 3: Determining h via the J and comparing them with the obtained experimental values

No.	J	$hExp.$	$hDet.$	$Error$
1	1.12	0.0907	0.03290206	0.05779794
2	1.12	0.1064	0.05032132	0.05607868
3	1.8	0.1456	0.09216155	0.05343845
4	2.13	0.172	0.12091983	0.05108017
5	2.23	0.1796	0.12963446	0.04996554
6	2.48	0.2004	0.15142104	0.04897896
7	3.02	0.243	0.19848005	0.04451995
8	3.64	0.2938	0.25251076	0.04128924
9	4.12	0.3319	0.2943409	0.030246591
10	10.07	0.8114	0.81286153	0.00146153

where J is unknown edge in graph and J_{v11} is first edges, while h refers to vertices of the experiment.

$$
\begin{aligned}
&=\frac{(J-61.25)1.825-(J-138.61)0.635}{(138.61-62.5)}\\
&=\frac{1.825J-111.78125-0.0635J+88.01735}{76.11}\\
&=\frac{1.19J-23.7639}{14.5}\\
&=0.01538263J-0.31217974
\end{aligned}
$$

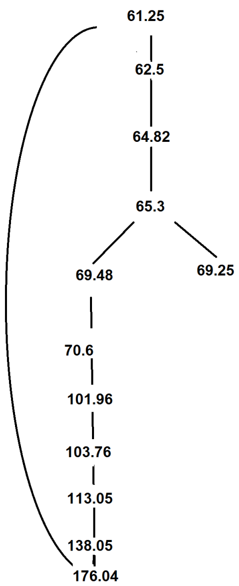

Figure 2: h via the j and comparing them with the obtained experimental values using graph theory

Remark 3. *In Table 4, we find that the error rate is somewhat greater than in Table 2, which means that the radiation level in potatoes cannot be determined more accurately.*

Table 4: Determining h via the j and comparing them with the obtained experimental values

No.	j	$hExp.$	$hDet.$	$Error$
1	61.25	0.635	0.63000451	0.00499549
2	62.5	0.648	0.64923464	0.00123464
3	64.82	0.672	0.68492234	0.01292234
4	65.3	0.677	0.692306	0.015306
5	69.25	0.718	0.75306739	0.003506739
6	69.48	0.71	0.75660539	0.04660539
7	70.6	0.732	0.77383394	0.04183321
8	101.96	1.057	1.25623321	0.19923321
9	103.67	1.076	1.28392195	0.20792195
10	113.05	1.172	1.42682658	0.25482658
11	138.61	1.437	1.8200066	0.3830066
12	176.04	1.825	2.39577845	0.57077845

4 Conclusion

In this paper, the following points are concluded:
Comparing Table 1 with Table 3, we note that the error ratio in determining the radiation level in potatoes when using the numerical model is less than the graph, and this means that the numerical model is better than the graph method in determining the radiation ratio in the potato crops. Also, by comparing Table 2 with Table 4, also we note that the error ratio in determining the radiation level in wheat, by using the numerical model, is less than the graph, and this means that the numerical model is better than the graph in determining the radiation ratio in the wheat crop.

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