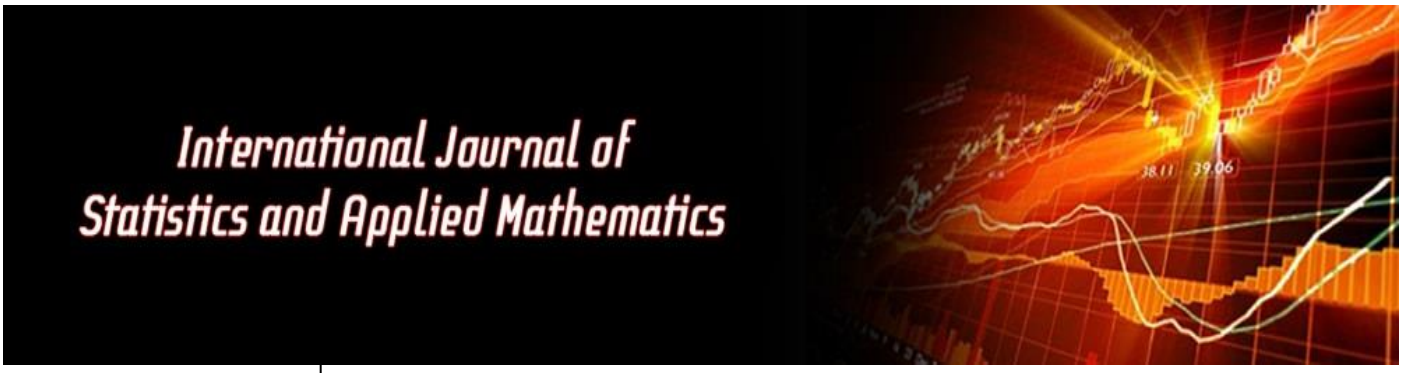
International Journal of Statistics and Applied Mathematics 2018; 3(4): 166-171



ISSN: 2456-1452
Maths 2018; 3(4): 166-171

www.mathsjournal.com
Received: 18-05-2018
Accepted: 19-06-2018

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Zagreb indices and Zagreb energies of some chemical compounds

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Abstract
Topological indices are the tools provided by the mathematician to the chemists through graph the theory. Topological index is the number with the property that for each graph G_1 which is isomorphic G_2 implies topological indices of G_1 and G_2 are equal. The energy concept was introduces by I Gutman in the year 1978. Zagreb energy has its own importance in the study of physic-chemical properties of chemical compound. That is often modeled by chemical compound. In this paper, we find first Zagreb index, second Zagreb index. Hyper Zagreb index, First multiple Zagreb index, Second multiple Zagreb index, First Zagreb energy, second Zagreb energy and Hyper Zagreb energy of some chemical compounds.

Keywords: Zagreb index, Zagreb energy, glucose, cholesterol, vitamins

1. Introduction
In this article "graph" (molecular graph) referred as is simple finite undirected and connected graph. Let $G = (V, E)$ is a graph with vertex set $V = (v_1, v_2, v_3, \ldots\ldots v_n)$ and the edge set$E = (e_1, e_2, e_3, \ldots\ldots e_n)$. $v_i v_j$ Denotes an edge in G if v_i and v_j are adjacent in G. Topological indices [1, 9] are the invariant by which the properties of chemical compound are studied and they are modeled as molecular graph based on the structure descriptors [2]. These descriptors help to represent he structural formula of a chemical compound. The vertices of a graph represent the atoms of chemical compound and edges represent the chemical bonds [3].
Recently the authors of [10] have obtained the wiener indices and Zagreb indices for some chemical compounds. By this motivation we have computed Zagreb indices of Glucose, Cholesterol, Vitamin C, Vitamin D, Vitamin K and ethanol. And Zagreb energies of Glucose and Vitamin C are obtained.
We refer the following definitions to compute the required Zagreb indices and Zagreb energies for the said chemical compounds.

Definition 1.1: Let $G = (V, E)$ is a simple connected graph, and $d_i = \deg(v_i)$ and $d_j = \deg(v_j)$ then first and second Zagreb index [11] is defined as
First Zagreb index $= M_1(G) = \sum_{e=v_i v_j \in E(G)}(d_i + d_j)$
Second Zagreb index $= M_2(G) = \sum_{e=v_i v_j \in E(G)}(d_i d_j)$
These topological indices were introduced by M Ghorbani and N Azmi [8].

Definition 1.2: The hyper Zagreb index of simple connected graph was introduced by G H Shirdel, H Rezapour and A M Sayadi [4]. It is defined as

Hyper Zagreb index of $G = M_H(G) = \sum_{e=v_i v_j \in E(G)}(v_i + v_j)^2$

Definition 1.3: The first and second multiple Zagreb index **[7]** of simple connected graph were introduced by I Gutman [6]. It is defined as

First multiple Zagreb index = $PM_1(G) = \prod_{e=v_i v_j \in E(G)}(d_i + d_j)$

Second multiple Zagreb index of G, $PM_2(G) = \prod_{e=v_iv_j \in E(G)}(d_i d_j)$

Definition 1.4: The Zagreb matrices [5] for a graph G are defined as follows

First Zagreb matrix = $Z^{(1)} = z_{ij} = \begin{cases} d_{ii}^2 \; for \; v_i \in V(G) \\ 0 \; otherwise \end{cases}$ (1)

Second Zagreb matrix = $Z^{(2)} = z_{ij} = \begin{cases} d_i d_j \; for \; v_i v_j \in E(G) \\ 0 \; for \; i = j \\ 0 \; otherwise \end{cases}$ (2)

Hyper Zagreb matrix = $Z^{(H)} = z_{ij} = \begin{cases} (d_i + d_j)^2 \; for \; v_i v_j \in E(G) \\ 0 \; for \; i = j \\ 0 \; otherwise \end{cases}$ (3)

2. Zagreb Indices of a graph G

First and second Zagreb indices are the topological indices which are the graph based molecular structure descriptors. These indices have been introduced by I Gutman and N Trinajstic more than thirty years before. Hyper Zagreb index was introduced by G H Shirdel, H Rezapour and A M Sayadi.

Example 2.1: Let G be the graph with 4-vertices say v_1, v_2, v_3, v_4 as shown in the figure 1

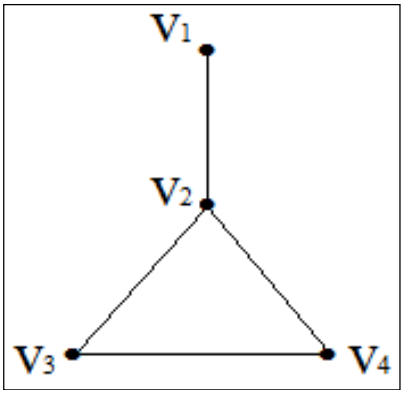

Fig 2.1: Simple Graph$G$ with 4 vertices

2.2 Zagreb indices of a graph G of figure 2.1

Here $|m_{ij}|$ denotes the number of edges in the graph joining the vertices of degree $i \; and \; j$.
Where $i \; and \; j$ = 1,2,3 ……. max[deg(v)] For the graph of figure 2.1, we have,
$|m_{13}| = 1$, $|m_{22}| = 1$ and $|m_{23}| = 2$. Using the definitions (1.1) to (1.4) we obtain the Zagreb indices and Zagreb energies for the graph G shown in the figure 2.1

First Zagreb index of G, $M_1(G) = \sum_{e=v_iv_j \in E(G)}(d_i + d_j)$where $d_i = \deg\,(v_i) \; and \; d_j = \deg(v_j)$

$$= |m_{13}|(1+3) + |m_{22}|(2+2) + |m_{23}|(2+3)$$
$$= 1(4) + 1(4) + 2(5) = 18$$

Second Zagreb index of$G$, $M_2(G) = \sum_{e=v_iv_j \in E(G)}(d_i \times d_j)$

$$= |m_{13}|(1*3) + |m_{22}|(2*2) + |m_{23}|(2*3)$$
$$= 1(3) + 1(4) + 2(6) = 19$$

Hyper Zagreb index of G $M_H(G) = \sum_{e=v_iv_j \in E(G)}(d_i + d_j)^2$

$$= |m_{13}|(1+3)^2 + |m_{22}|(2+2)^2 + |m_{23}|(2+3)^2$$
$$= 1(16) + 1(16) + 2(25) = 57$$

First multiple Zagreb index of G, $PM_1(G) = \prod_{e=v_iv_j \in E(G)}(d_i + d_j)$

$$= \prod_{e=v_iv_j \in m_{13}}(d_1 + d_3) \prod_{e=v_iv_j \in Em_{22}}(d_2 + d_2) \prod_{e=v_iv_j \in m_{24}}(d_2 + d_4)$$
$$= (1+3)^{|m_{13}|}(2+2)^{|m_{22}|}(2+3)^{|m_{23}|} = 4^1 4^1 5^2 = 400$$

Second multiple Zagreb index of G, $PM_2(G) = \prod_{e=v_iv_j \in E(G)}(d_i d_j)$

$$= \prod_{e=v_iv_j \in m_{13}}(d_1 d_3) \prod_{e=v_iv_j \in Em_{22}}(d_2 d_2) \prod_{e=v_iv_j \in m_{24}}(d_2 d_4)$$

$$= (1 \times 3)^{|m_{13}|}(2 \times 2)^{|m_{22}|}(2 \times 3)^{|m_{23}|} = 3^1 4^1 6^2 = 432$$

3. Zagreb energies of a graph G shown in figure 2.1

We refer the definition 1.4 of Zagreb matrices $Z^{(n)} = (z_{ij})$ for$n = 1,2\ and\ H$, representing first Zagreb matrix, second Zagreb matrix and hyper Zagreb matrix of a graph G respectively. Let $\lambda_1, \lambda_2, \lambda_3, \dots \dots \dots \lambda_n$ be the Eigen values of particular Zagreb matrix of a graph G. The values are assumed to be in the increasing order, that is $\lambda_1 \geq \lambda_2 \geq \lambda_3 \geq \cdots \dots \dots \geq \lambda_n$. Since $Z(G)$ is real and symmetric. Its eigen values are real number. The Zagreb energy $ZE(G)$ of graph is defined to the sum of absolute values of its Eigen values of graph G that is $ZE(G) = \sum_1^n |\lambda_i|$

The first Zagreb Matrix of a graph G is $Z^{(1)}M(G) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 9 & 0 & 0 \\ 0 & 0 & 4 & 0 \\ 0 & 0 & 0 & 4 \end{bmatrix}$ since $Z^1M(G)$ is a diagonal matrix, diagonal elements represent Eigen values of the matrix.

Therefore first Zagreb energy, $Z^{(1)}E(G) = |1|(1) + |9|(1) + |4|(2) = 18.$

Second Zagreb matrix of $G$is $Z^{(2)}M(G) = \begin{bmatrix} 0 & 3 & 0 & 0 \\ 3 & 0 & 6 & 6 \\ 0 & 6 & 0 & 4 \\ 0 & 6 & 4 & 0 \end{bmatrix}$ reducing to a diagonal matrix

$$Z^{(2)}M(G) = \begin{bmatrix} 3 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 4 & 0 \\ 0 & 0 & 0 & 4 \end{bmatrix}$$ the eigen values are 3,3,4 and 4

Therefore second Zagreb energy, $Z^{(2)}E(G) = |3|(2) + |4|(2) = 14.$

Hyper Zagreb Matrix of G is $Z^{(H)}M(G) = \begin{bmatrix} 0 & 16 & 0 & 0 \\ 16 & 0 & 25 & 25 \\ 0 & 25 & 0 & 16 \\ 0 & 25 & 16 & 0 \end{bmatrix}$ reducing to a diagonal matrix

$$Z^{(H)}M(G) = \begin{bmatrix} 16 & 0 & 0 & 0 \\ 0 & 16 & 0 & 0 \\ 0 & 0 & 16 & 0 \\ 0 & 0 & 0 & 16 \end{bmatrix}$$

Therefore hyper Zagreb energy, $Z^{(H)}E(G) = |16|(4) = 64.$

4. Zagreb indices of Glucose:

Chemical structure of Glucose is $(C_6H_{12}O_6)$. Glucose is commonly known as "sugar". It is an important source of energy needed by the cells and organs. For human being energy is required for the normal functioning of the parts of the body. Brain and red blood cells completely depend on Glucose. Level of glucose in the blood is controlled by the insulin which is released by pancreas. Now we obtain the Zagreb indices of glucose.

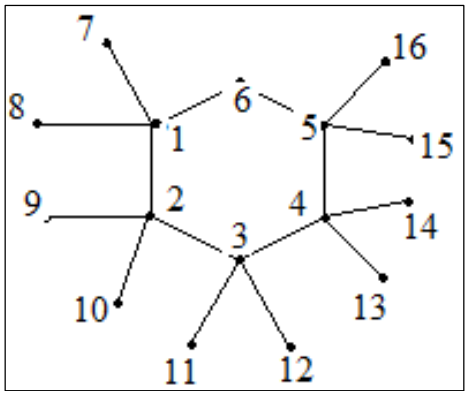

Fig 4.1: Chemical Structure of Glucose$(C_6H_{12}O_6)$

From the graph of Glucose,

$|m_{14}| = 10, |m_{24}| = 2, |m_{44}| = 4$

Theorem 4.1 First Zagreb index of Glucose is $M_1(C_6H_{12}O_6) = 94$

Proof: First Zagreb index of Glucose, $M_1(C_6H_{12}O_6) = \sum_{e=v_iv_j \in E(G)}(d_i + d_j)$

Where $d_i = \deg(v_i)$ and $d_j = \deg(v_j)$

$= |m_{14}|(1+4) + |m_{24}|(2+4) + |m_{44}|(4+4)$

$= 10(5) + 2(6) + 4(8)$

$= 50 + 12 + 32 = 94.$

Theorem 4.2: Second Zagreb index of Glucose is $M_1(C_6H_{12}O_6) = 120$

Proof: Second Zagreb index of Glucose, $M_2(C_6H_{12}O_6) = \sum_{e=v_iv_j \in E(G)}(d_i \times d_j)$

$= |m_{14}|(1 \times 4) + +|m_{24}|(2 \times 4) + |m_{44}|(4 \times 4)$

$= 10(4) + 2(8) + 4(16) = 120$

Theorem 4.3: Hyper Zagreb index of Glucose is $M_1(C_6H_{12}O_6) = 578$

Proof: Hyper Zagreb index of Glucose l, $M_H(C_6H_{12}O_6) = \sum_{e=v_iv_j \in E(G)}(d_i + d_j)^2$

$= |m_{14}|(1+4)^2 + |m_{24}|(2+4)^2 + |m_{44}|(4+4)^2$

$= 12(25) + 2(36) + 4(64) = 578$

Theorem 4.4: First multiple Zagreb index of Glucose is $M_1(C_6H_{12}O_6) \approx 1.44 \times 10^{12}$

Proof: First multiple Zagreb index of Glucose $= PM_1(C_6H_{12}O_6) \approx \prod_{e=v_iv_j \in E(G)}(d_i + d_j)$

$$= \prod_{e=v_iv_j \in Em_{14}} (d_1 + d_4) \prod_{e=v_iv_j \in m_{24}} (d_2 + 4) \prod_{e=v_iv_j \in m_{44}} (d_4 + d_4)$$

$= (5^{10})(6^2)(8^4) \approx 1.44 \times 10^{12}$

Theorem 4.5: Second multiple Zagreb index of Glucose is $M_1(C_6H_{12}O_6) \approx 4.3980465 \times 10^{12}$

Proof: Second multiple Zagreb index of Glucose $= PM_2(C_6H_{12}O_6.) = \prod_{e=v_iv_j \in E(G)}(d_i \times d_j)$

$$= \prod_{e=v_iv_j \in Em_{14}} (d_1 \times d_4) \prod_{e=v_iv_j \in m_{24}} (d_2 \times d_4) \prod_{e=v_iv_j \in m_{44}} (d_4 \times d_4)$$

$= (4^{10})(8^2)(16^4) \approx 4.3980465 \times 10^{12}$

Zagreb indices of some chemical compounds are computed and are as follows

Chemical compound/Zagreb Index	$M_1(G)$	$M_2(G)$	$M_H(G)$	$PM_1(G)$	$PM_2(G)$
Glucose ($C_6H_{12}O_6$)	94	120	578	1.44×10^{12}	4.398×10^{12}
Cholesterol ($C_{27}H_{46}O$)	158	195	836	4.779×10^{21}	3.105×10^{23}
Vitamin C ($C_6H_8O_6$)	52	60	256	20736000	34012224
Vitamin D	144	176	740	9.364×10^{19}	4.852×10^{21}
Vitamin K ($C_{31}H_{46}O_2$)	158	178	754	3.131×10^{22}	2.210×10^{23}
Ethanol (C_2H_5OH)	42	46	234	450000	262144

5. Zagreb energies of some chemical compounds

Here we compute the Zagreb energies of Glucose, Vitamin C, With reference to the chemical structure of Glucose given in figure 2 and using the definition 1.4 on Zagreb Matrices,

Theorem 5.1: First Zagreb energy of Glucose ($C_6H_{12}O_6$) is 94

Proof: First Zagreb matrix of Glucose ($C_6H_{12}O_6$) =

$$\begin{bmatrix}
16 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 16 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 16 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 16 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 16 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

Characteristic polynomial of the matrix is
$\lambda^{16} - 94\lambda^{15} + 3765\lambda^{14} - 83900\lambda^{13} + 1143410\lambda^{12}$

$-9941988\lambda^{11} + 56675842\lambda^{10} - 218589280\lambda^{9} + 588595725\lambda^{8}$

$-1133733070\lambda^{7} + 1584840073\lambda^{6} - 1613732052\lambda^{5}$

$+1186552640\lambda^{4} - 614451200\lambda^{3} + 212828160\lambda^{2}$

$-44302336\lambda + 4194304$

Eigen values of first Zagreb matrix $Z^{(1)}M(C_6H_{12}O_6)$ are
$\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = 16,$

$\lambda_6 = 4, \lambda_7 = \lambda_8 = \lambda_9 = \lambda_{10} = \lambda_{11} = \lambda_{12} = \lambda_{13} = \lambda_{14} = \lambda_{15} = \lambda_{16} = 1$

Then first Zagreb energy of $Z^{(1)}E(C_6H_{12}O_6)$

$= 5(16) + 1(4) + 10(1) = 94.$

Theorem 5.2: Second Zagreb energy of Glucose $(C_6H_{12}O_6) \approx 122.3038027$
Proof: Second Zagreb matrix of Glucose $(C_6H_{12}O_6)$ is

$$\begin{bmatrix}
0 & 16 & 0 & 0 & 0 & 8 & 4 & 4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
16 & 0 & 16 & 0 & 0 & 0 & 0 & 0 & 4 & 4 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 16 & 0 & 16 & 0 & 0 & 0 & 0 & 0 & 0 & 4 & 4 & 0 & 0 & 0 & 0 \\
0 & 0 & 16 & 0 & 16 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 4 & 4 & 0 & 0 \\
0 & 0 & 0 & 16 & 0 & 8 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 4 & 4 \\
8 & 0 & 0 & 0 & 8 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

Characteristic polynomial of the matrix is

$\lambda^{16} - 1312\lambda^{14} + 419840\lambda^{12} - 33619968\lambda^{10} + 156237824\lambda^{8} - 167772160\lambda^{6}$

Eigen values of second Zagreb matrix $Z^{(2)}M(C_6H_{12}O_6)$ are

$\lambda_1 = -29.6068, \lambda_2 = -17.7980, \lambda_3 = -10.6675, \lambda_4 = -1.7980, \lambda_5 = -1.2816,$

$\lambda_6 = -5.1682 \times e^{-16}, \lambda_7 = -2.7321 \times e^{-16}, \lambda_8 = -3.1218 \times e^{-16},$

$\lambda_9 = 1.5842 \times e^{-16}, \lambda_{10} = 3.2816 \times e^{-16},$

$\lambda_{11} = 7.6740 \times e^{-16}, \lambda_{12} = 1.2816,$

$\lambda_{13} = 1.7980, \lambda_{14} = 10.6675, \lambda_{15} = 17.7980, \lambda_{16} = 29.6068$

Therefore second Zagreb energy of Glucose = $Z^{(2)}M(C_6H_{12}O_6) \approx 122.3038027$

Theorem 5.3: Hyper Zagreb energy of Glucose $(C_6H_{12}O_6) \approx 571.3126075$
Hyper Zagreb matrix of Glucose $(C_6H_{12}O_6)$ is

$$\begin{bmatrix} 0 & 64 & 0 & 0 & 0 & 36 & 25 & 25 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 64 & 0 & 64 & 0 & 0 & 0 & 0 & 0 & 25 & 25 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 64 & 0 & 64 & 0 & 0 & 0 & 0 & 0 & 0 & 25 & 25 & 0 & 0 & 0 & 0 \\ 0 & 0 & 64 & 0 & 64 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 25 & 25 & 0 & 0 \\ 0 & 0 & 0 & 64 & 0 & 36 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 25 & 25 \\ 36 & 0 & 0 & 0 & 36 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 25 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 25 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 25 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 25 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 25 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 25 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 25 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 25 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 25 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 25 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Characteristic polynomial of the matrix is $\lambda^{16} - 25226\lambda^{14} + 172207144\lambda^{12}$

$-350145137744\lambda^{10} + 1142234312500000\lambda^{8} - 93798828125000000\lambda^{6}$

Eigen values of Hyper Zagreb matrix $Z^{(H)}M(C_6H_{12}O_6)$ are
$\lambda_1 = -124.8655, \lambda_2 = -79.6865, \lambda_3 = -53.9084, \lambda_4 = -15.6865, \lambda_5 = -11.5104,$
$\lambda_6 = -4.5376 \times e^{-15}, \lambda_7 = -3.3771 \times e^{-15}, \lambda_8 = -8.2175 \times e^{-15},$
$\lambda_9 = 1.1579 \times e^{-15}, \lambda_{10} = 1.5540 \times e^{-15},$
$\lambda_{11} = 5.7981 \times e^{-15}, \lambda_{12} = 11.5104, \lambda_{13} = 15.6865, \lambda_{14} = 53.9084,$
$\lambda_{15} = 79.665, \lambda_{16} = 124.8655$

Therefore Hyper Zagreb energy of Glucose = $Z^{(H)}M(C_6H_{12}O_6) \approx 571.3126075$
Zagreb energies of some chemical compounds are computed and are as follows

Chemical compound/Zagreb energy	First Zagreb energy (Approx)	Second Zagreb energy (Approx)	Hyper Zagreb energy (Approx)
Glucose ($C_6H_{12}O_6$)	94	122.3038027	571.3126075
Vitamin C ($C_6H_8O_6$)	52	68.0456	289.9346

6. Conclusion

We have computed Zagreb indices for Glucose, Cholesterol, Ethanol, and for Vitamins like C,D, K which will play major role on the human body and also Zagreb energies have been computed for Glucose and Vitamin C. These calculated values certainly, help us to study in depth the effect of these on human beings. So that these chemical compounds can be used appropriately for the betterment of human beings.

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