Topological Indices of Vitamin C

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Abstract: Graph theory has provided chemists with a variety of useful tools, like topological indices. A topological index Top(G) of a graph G is a number with the property that for every graph H isomorphic to G, i.e Top(H) = Top(G). In this article we compute ABC index, Randic connectivity index, Sum connectivity index, GA index, GA_5 index, First Zagreb index, Second Zagreb index, first multiple Zagreb index, second multiple Zagreb index, Augmented Zagreb index, Harmonic index, and Hyper Zagreb index of Vitamin C. Also, we have computed some polynomials like First Zagreb polynomial, Second Zagreb polynomial, Third Zagreb polynomial, forgotten polynomial, Forgotten topological index, and symmetric division index of Vitamin C.

Mathematics subject classification: 05C09, 05C10, 05C31.

Keywords: ABC index, Randic connectivity index, Sum connectivity index, GA index, GA_5 index, First Zagreb index, Second Zagreb index, first multiple Zagreb index, second multiple Zagreb index, Augmented Zagreb index, Harmonic index, Hyper Zagreb, First Zagreb polynomial, Second Zagreb polynomial, Third Zagreb polynomial, forgotten polynomial, Forgotten topological index, and symmetric division index.

I. INTRODUCTION

Vitamin C, also known as ascorbic acid, is a water-soluble vitamin that plays a crucial role in various bodily functions. It is essential for the growth and repair of tissues, acts as an antioxidant, and helps protect cells from damage caused by free radicals. Additionally, vitamin C is important for the synthesis of collagen, a protein necessary for skin, cartilage, tendons, ligaments, and blood vessels.

Vitamin C is found in many fruits and vegetables, with high concentrations in citrus fruits (like oranges and lemons), strawberries, kiwi, bell peppers, broccoli, and spinach. Because it is water-soluble and sensitive to heat, cooking can reduce its levels in food, making raw or lightly cooked sources more beneficial.

Immune Function: Vitamin C supports the immune system and can help reduce the duration and severity of colds.

Antioxidant Properties: It helps neutralize free radicals, potentially reducing the risk of chronic diseases.

Skin Health: Its role in collagen production makes it vital for skin integrity and wound healing.

Iron Absorption: Vitamin C enhances the absorption of non-heme iron from plant-based foods, which is important for preventing anemia.

The recommended dietary allowance (RDA) varies by age, gender, and life stage, with adult men typically needing about 90 mg per day and adult women about 75 mg. Smokers and pregnant or breastfeeding women may require higher amounts.

A deficiency in vitamin C can lead to scurvy, characterized by symptoms like fatigue, gum disease, and skin problems. While rare in developed countries, it can occur, particularly among individuals with limited access to fresh produce.

Topological indices are numerical values derived from the structure of a molecule, often used in cheminformatics to predict various properties of chemical compounds. For vitamin C (ascorbic acid), some relevant topological indices include:

Degree-Based Indices: These consider the degree of each vertex (atom) in the molecular graph. For vitamin C, this would involve looking at the carbon, oxygen, and hydrogen atoms and their connectivity.

Zagreb Indices: These are based on the degrees of the vertices and can help analyse molecular stability and reactivity.

Randić Index: This index is based on the degrees of the atoms and can indicate the complexity of the molecular structure.

These indices can help in understanding vitamin C's chemical behaviour, interactions, and potential biological activity. However, detailed calculations and comparisons would typically be conducted using specialized software in cheminformatics.

Topological indices are molecular descriptors which describes the structures of the chemical compounds and also helps in predicting the physico-chemical changes that occurs in the compound. A molecular graph which is a symbol of the structural formula of chemical compounds in terms of graph theory, where vertices and edges are corresponds to atoms and chemical bonds. Consider $G = (V, E)$ be a graph having vertex and edge set U and V. The degree of vertex $u \in E(G)$ and edge connecting the vertices are represented by d_u and uv.

In the current article, we determine some topological indices like Randic connectivity index, Geometric-arithmetic connectivity index, atom-bond connectivity index, sum connectivity index, Fourth atom-bond connectivity index, Fifth geometric-arithmetic connectivity index, Harmonic index, and some Zagreb indices [2-6]. Along with this we also determine few polynomials.

The ABC index was introduced by Estrada et al. in 1990' s which is degree based molecular descriptor. This index can be used for modelling of thermodynamic properties and explaining the stability of alkanes of an organic chemical compound [6-7].

II. MAIN RESULTS

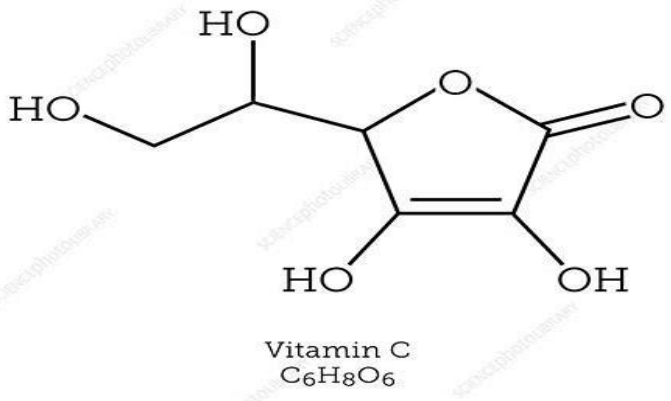

Figure: Molecular Graph (Vitamin C)

1. ATOM BOND CONNECTIVITY INDEX

Let $G = (V, E)$ be a molecular graph having d_u and d_v as degree of vertex u and v, hence ABC index of G is defined as $ABC(G) = \sum_{uv \in E} \sqrt{\frac{d_u + d_v - 2}{d_u d_v}}$.

Theorem 1.1: Atom bond connectivity index of Vitamin C is **8.7611.**

Proof: Let us consider a molecular graph of Vitamin C and Vitamin C consists of total 12 number of edges and 12 number of vertices. The graph contains total number of edges in the form of $E_{i,j}$, where $E_{i,j}$represents the edges$|E_{1,2}| = 1, |E_{1,3}| = 4, |E_{2,3}| = 3, |E_{3,3}| = 4.$

Atom bond connectivity index of Vitamin C is

$$ABC(\text{Vitamin C}) = \sum_{uv\in E}\sqrt{\frac{d_u + d_v - 2}{d_u d_v}}$$

$$= |E_{1,2}|\sqrt{\frac{1+2-2}{1\cdot 2}} + |E_{1,3}|\sqrt{\frac{1+3-2}{1\cdot 3}} + |E_{2,3}|\sqrt{\frac{2+3-2}{2\cdot 3}} + |E_{3,3}|\sqrt{\frac{3+3-2}{3\cdot 3}}$$

ABC(Vitamin C)= 8.7611.

2. FOURTH ATOM BOND CONNECTIVITY INDEX

The fourth atom bond connectivity index $ABC_4(G)$ was introduced in 2010 by M. Ghorbani et al [10], which is degree based topological index. Hence for a graph G which is defined as

$$ABC_4(G) = \sum_{uv\in E}\sqrt{\frac{s_u + s_v - 2}{s_u s_v}}.$$

Where s_u represents sum of the degrees of all neighbours of vertex u,

$S_u = \sum_{uv\in E(G)} d_u$, similarly, for S_v.

Theorem 2.1: Fourth atom bond connectivity index of Vitamin C is **6.7816.**

Proof: consider a molecular graph of Vitamin C, having total number of edges in the form of $e_{i,j}$, where in $e_{i,j}$, i represents s_u and j represents s_v. Hence the edges of Vitamin C are $|e_{2,4}| = 1, |e_{3,6}| = 2, |e_{3,7}| = 2, |e_{4,6}| = 1, |e_{6,6}| = 1, |e_{6,7}| = 1, |e_{6,8}| = 2, |e_{7,7}| = 1, |e_{7,8}| = 1.$

Fourth atom bond connectivity index of Vitamin C is

$$ABC_4(\text{Vitamin C}) = \sum_{uv\in E}\sqrt{\frac{s_u + s_v - 2}{s_u s_v}}$$

$$= |e_{2,4}|\sqrt{\frac{2+4-2}{2\cdot 4}} + |e_{3,6}|\sqrt{\frac{3+6-2}{3\cdot 6}} + |e_{3,7}|\sqrt{\frac{3+7-2}{3\cdot 7}} + |e_{4,6}|\sqrt{\frac{4+6-2}{4\cdot 6}} + |e_{6,6}|\sqrt{\frac{6+6-2}{6\cdot 6}} + |e_{6,7}|\sqrt{\frac{6+7-2}{6\cdot 7}} + |e_{6,8}|\sqrt{\frac{6+8-2}{6\cdot 8}} + |e_{7,7}|\sqrt{\frac{7+7-2}{7\cdot 7}} + |e_{7,8}|\sqrt{\frac{7+8-2}{7\cdot 8}}$$

ABC_4(Vitamin C)= 6.7816.

3. RANDIC CONNECTIVITY INDEX

Randic index was introduced by Milan Randic in 1975 which is one of the oldest and first degree based topological index gives quantitative assessment of branching of molecules and is defined as $\chi(G) = \sum_{e=uv\in E(G)} \frac{1}{\sqrt{d_u d_v}}$ [16] .

Theorem 3.1: Randic connectivity index of Vitamin C is **3.5746.**

Proof: Randic connectivity index of Vitamin C is

$\chi(\text{Vitamin C}) = \sum_{e=uv\in E(G)} \frac{1}{\sqrt{d_u d_v}}$

$= |E_{1,2}| \frac{1}{\sqrt{1\cdot 2}} + |E_{1,3}| \frac{1}{\sqrt{1\cdot 3}} + |E_{2,3}| \frac{1}{\sqrt{2\cdot 3}} + |E_{3,3}| \frac{1}{\sqrt{3\cdot 3}}.$

$\chi(\text{Vitamin C}) = 3.5746.$

4. SUM CONNECTIVITY INDEX

Sum connectivity index of a graph G was introduced by Zhou and N. Trinajstic for simple connected graph G and is defined as $S(G) = \sum_{e=uv\in E(G)} \frac{1}{\sqrt{d_u + d_v}}$.

The improvisation of sum connective index can be seen in [24, 25].

Theorem 4.1: Sum connectivity index of Vitamin C is **5.5520.**

Proof: Sum connectivity index of Vitamin C is

$S(\text{Vitamin C}) = \sum_{e=uv\in E(G)} \frac{1}{\sqrt{d_u + d_v}}$

$= |E_{1,2}| \frac{1}{\sqrt{1+2}} + |E_{1,3}| \frac{1}{\sqrt{1+3}} + |E_{2,3}| \frac{1}{\sqrt{2+3}} + |E_{3,3}| \frac{1}{\sqrt{3+3}}.$

$S(\text{Vitamin C}) = 5.5520.$

5. GEOMETRIC - ARITHMETIC INDEX

The Geometric - arithmetic index was introduced by D. Vukicevic et al [20] for a graph G and is defined as

$GA(G) = \sum_{e=uv\in E(G)} \frac{2\sqrt{d_u d_v}}{d_u + d_v}$. Further studies on this index can be seen in [3,4,22].

Theorem 5.1: Geometric - Arithmetic index of Vitamin C is **11.3463.**

Proof: The Geometric -Arithmetic index of Vitamin C is

$$GA(\text{Vitamin C}) = \sum_{e=uv\in E(G)} \frac{2\sqrt{d_u d_v}}{d_u + d_v}$$

$$= |E_{1,2}| \frac{2\sqrt{1\cdot 2}}{1+2} + |E_{1,3}| \frac{2\sqrt{1\cdot 3}}{1+3} + |E_{2,3}| \frac{2\sqrt{2\cdot 3}}{2+3} + |E_{3,3}| \frac{2\sqrt{3\cdot 3}}{3+3}$$

$GA(\text{Vitamin C}) = 11.3463.$

6. FIFTH GEOMETRIC – ARITHMETIC INDEX

The fifth geometric-arithmetic index was introduced in 2011 by A. Graovac et al [11] for a graph G and is defined as $GA_5(G) = \sum_{e=uv\in E(G)} \frac{2\sqrt{S_u S_v}}{S_u + S_v}$.

Where S_u and S_v represents sum of the degrees of all neighbors of vertex u and v in G.

Theorem 6.1: Fifth geometric – arithmetic index of Vitamin C is**11.6156.**

Proof: Fifth geometric – arithmetic index of Vitamin C is

$$GA_5(\text{Vitamin C}) = \sum_{e=uv\in E(G)} \frac{2\sqrt{S_u S_v}}{S_u + S_v}$$

$$= |e_{2,4}|\frac{2\sqrt{2\cdot4}}{2+4} + |e_{3,6}|\frac{2\sqrt{3\cdot6}}{3+6} + |e_{3,7}|\frac{2\sqrt{3\cdot7}}{3+7} + |e_{4,6}|\frac{2\sqrt{4\cdot6}}{4+6} + |e_{6,6}|\frac{2\sqrt{6\cdot6}}{6+6} +$$

$$|e_{6,7}|\frac{2\sqrt{6\cdot7}}{6+7} + |e_{6,8}|\frac{2\sqrt{6\cdot8}}{6+8} + |e_{7,7}|\frac{2\sqrt{7\cdot7}}{7+7} + |e_{7,8}|\frac{2\sqrt{7\cdot8}}{7+8} +$$

$GA_5(\text{Vitamin C}) = 11.6156.$

7. FIRST, SECOND AND THIRD ZAGREB INDICES

The first and Second Zagreb index was first appeared in the topological formula in 1972 by I. Gutman and N. Trinajstic for the total π-energy of conjugated molecules [12]. This index has been used in applications towards QSPR, QSAR and branching indices. Further details on chemical applications and studies towards two Zagreb indices can be found in [18,19,2,13,23,24,25]. Hence the first and second Zagreb indices is defined for a graph G is given below:

$$Z_1(G) = \sum_{e=uv\in E(G)} (d_u + d_v)$$

$$Z_2(G) = \sum_{e=uv\in E(G)} (d_u d_v).$$

The third Zagreb index was introduced by Fath-Tabar in 2011 [1].

For a graph G and is defined as

$$ZG_3(G) = \sum_{e=uv\in E(G)} |d_u - d_v|.$$

The first, second and third Zagreb polynomials was introduced by Fath-Tabar in 2011 for a simple connected graph G and is defined as [1]

$ZG_1(G) = \sum_{e=uv\in E(G)} x^{(d_u + d_v)}$,

$ZG_2(G) = \sum_{e=uv\in E(G)} x^{d_u d_v}$ and

$ZG_3(G) = \sum_{e=uv\in E(G)} x^{|d_u - d_v|}$.

Theorem 7.1: First Zagreb index of Vitamin C is **58**.

Proof: first Zagreb index of Vitamin C is

$$Z_1(\text{Vitamin C}) = \sum_{e=uv\in E(G)} (d_u + d_v)$$

$$= |E_{1,2}|(1+2) + |E_{1,3}|(1+3) + |E_{2,3}|(2+3) + |E_{3,3}|(3+3)$$

$Z_1(\text{Vitamin C}) = 58.$

Theorem 7.2: First Zagreb polynomials of Vitamin C is $\mathbf{4x^6 + 3x^5 + 5x^4}$.

Proof: $ZG_1(\text{Vitamin C}) = \sum_{e=uv\in E(G)} x^{(d_u + d_v)}$

$$= |E_{1,2}|x^{(1+2)} + |E_{1,3}|x^{(1+3)} + |E_{2,3}|x^{(2+3)} + |E_{3,3}|x^{(3+3)}$$

$ZG_1(\text{Vitamin C}) = 4x^6 + 3x^5 + 5x^4.$

Theorem 7.3: Second Zagreb index of Vitamin C is **68.**

Proof: Second Zagreb index of Vitamin C is

$$Z_2(\text{Vitamin C}) = \sum_{e=uv\in E(G)}(d_u d_v)$$

$$= |E_{1,2}|(1\cdot 2) + |E_{1,3}|(1\cdot 3) + |E_{2,3}|(2\cdot 3) + |E_{3,3}|(3\cdot 3)$$

$$Z_2(\text{Vitamin C}) = 68.$$

Theorem 7.4: Second Zagreb polynomials of Vitamin C is $\mathbf{4x^9 + 3x^6 + 4x^3 + x^2}$.

Proof: $ZG_2(\text{Vitamin C}) = \sum_{e=uv\in E(G)} x^{d_u d_v}$.

$$= |E_{1,2}|x^{(1\cdot 2)} + |E_{1,3}|x^{(1\cdot 3)} + |E_{2,3}|x^{(2\cdot 3)} + |E_{3,3}|x^{(3\cdot 3)}$$

$$ZG_2(\text{Vitamin C}) = 4x^9 + 3x^6 + 4x^3 + x^2.$$

Theorem 7.5: Third Zagreb polynomials of Vitamin C is $\mathbf{4x^2 + 4x + 4}$.

Proof: $ZG_3(\text{Vitamin C}) = \sum_{e=uv\in E(G)} x^{|d_u - d_v|}$

$$= |E_{1,2}|x^{|1-2|} + |E_{1,3}|x^{|1-3|} + |E_{2,3}|x^{|2-3|} + |E_{3,3}|x^{|3-3|}$$

$$ZG_3(\text{Vitamin C}) = 4x^2 + 4x + 4.$$

8. FIRST AND SECOND MULTIPLE ZAGREB INDEX

M. Ghorbani and N. Azimi introduced Multiple Zagreb topological indices in 2012 for a graph G. Hence the first and second multiple Zagreb indices for a simple connected graph G is defined as

$PM_1(G) = \prod_{e=uv\in E(G)}(d_u + d_v)$. and

$PM_2(G) = \prod_{e=uv\in E(G)}(d_u d_v)$.

Some properties of these indices can be seen in [5,13,14].

Theorem 8.1: First multiple Zagreb index of Vitamin C is **124416000.**

Proof: First multiple Zagreb index of Vitamin C is

$$PM_1(\text{Vitamin C}) = \prod_{e=uv\in E(G)}(d_u + d_v)$$

$$= \prod_{e=uv\in E_{1,2}}(d_u + d_v)\prod_{e=uv\in E_{1,3}}(d_u + d_v)\prod_{e=uv\in E_{2,3}}(d_u + d_v)\prod_{e=uv\in E_{3,3}}(d_u + d_v)$$

$$PM_1(\text{Vitamin C}) = 124416000.$$

Theorem 8.2: Second multiple Zagreb index of Vitamin C is **229582512**.

Proof: Second multiple Zagreb index of Vitamin C is

$$PM_2(\text{Vitamin C}) = \prod_{e=uv\in E(G)} (d_u d_v)$$

$$= \prod_{e=uv\in E_{1,2}}(d_u d_v) \prod_{e=uv\in E_{1,3}}(d_u d_v) \prod_{e=uv\in E_{2,3}}(d_u d_v) \prod_{e=uv\in E_{3,3}}(d_u d_v)$$

$PM_2(\text{Vitamin C}) = 229582512.$

9. AUGMENTED ZAGREB INDEX

Furtula et al, introduced the Augmented Zagreb index for a graph G and is defined as $AZI(G) = \sum_{e=uv\in E(G)} \left[\frac{d_u d_v}{d_u + d_v - 2}\right]^3$ and further studies on this index can be seen in [8,15].

Theorem 9.1: Augmented Zagreb index of Vitamin C is **91.0625.**

Proof: Augmented Zagreb index of Vitamin C is

$$AZI(\text{Vitamin C}) = \sum_{e=uv\in E(G)} \left[\frac{d_u d_v}{d_u + d_v - 2}\right]^3$$

$$= |E_{1,2}| \left[\frac{1\cdot 2}{1+2-2}\right]^3 + |E_{1,3}| \left[\frac{1\cdot 3}{1+3-2}\right]^3 + |E_{2,3}| \left[\frac{2\cdot 3}{2+3-2}\right]^3 + |E_{3,3}| \left[\frac{3\cdot 3}{3+3-2}\right]^3$$

$AZI(\text{Vitamin C}) = 91.0625.$

10. HARMONIC INDEX

Zhong introduced Harmonic index for a graph G and is defined as[26] $H(G) = \sum_{e=uv\in E(G)} \frac{2}{d_u + d_v}$, further studies on this index can be found in [21,24].

Theorem 10.1: Harmonic index of Vitamin C is **5.2.**

Proof: Harmonic index of Vitamin C is

$$H(\text{Vitamin C}) = \sum_{e=uv\in E(G)} \frac{2}{d_u + d_v}$$

$$= |E_{1,2}| \left[\frac{2}{1+2}\right] + |E_{1,3}| \left[\frac{2}{1+3}\right] + |E_{2,3}| \left[\frac{2}{2+3}\right] + |E_{3,3}| \left[\frac{2}{3+3}\right]$$

$H(\text{Vitamin C}) = 5.2.$

11. HYPER ZAGREB INDEX

The Hyper Zagreb was introduced by G.H.Shirdel et al for a graph G and is defined as[17]

$HM(G) = \sum_{e=uv\in E(G)} (d_u + d_v)^2$ which is a distance based topological indices.

Theorem 11.1: Hyper Zagreb index of Vitamin C is **292.**

Proof: Hyper Zagreb index of Vitamin C is

$$HM(\text{Vitamin C}) = \sum_{e=uv\in E(G)} (d_u + d_v)^2$$

$$= |E_{1,2}|(1+2)^2 + |E_{1,3}|(1+3)^2 + |E_{2,3}|(2+3)^2 + |E_{3,3}|(3+3)^2$$

$HM(\text{Vitamin C}) = 292.$

12. FORGOTTEN TOPOLOGICAL INDEX

The forgotten topological index and its polynomial for a graph G is defined as

$F(G) = \sum_{e=uv\in E(G)}[(d_u)^2 + (d_v)^2]$ and

$F(G) = \sum_{e=uv\in E(G)} x^{[(d_u)^2+(d_v)^2]}$ for degree based topological indices [9].

Theorem 12.1: Forgotten topological index of Vitamin C is **156.**

Proof: $F(\text{Vitamin C}) = \sum_{e=uv\in E(G)}[(d_u)^2 + (d_v)^2]$

$$= |E_{1,2}|[1+4] + |E_{1,3}|[1+9] + |E_{2,3}|[4+9] + |E_{3,3}|[9+9]$$

$F(\text{Vitamin C}) = 156.$

Theorem 12.2: Forgotten polynomial of Vitamin C is $\mathbf{4x^{18} + x^{13} + 4x^{10} + x^5}$

Proof: $F(\text{Vitamin C}) = \sum_{e=uv\in E(G)} x^{[(d_u)^2+(d_v)^2]}$

$$= |E_{1,2}|x^{[1+4]} + |E_{1,3}|x^{[1+9]} + |E_{2,3}|x^{[4+9]} + |E_{3,3}|x^{[9+9]}$$

Hence $F(\text{Vitamin C}) = 4x^{18} + x^{13} + 4x^{10} + x^5$.

13. SYMMETRIC DIVISION INDEX

Symmetric division index for a graph G is defined as

$SSD(G) = \sum_{e=uv\in E(G)}\left\{\frac{\min(d_u,d_v)}{max(d_u,d_v)} + \frac{\max(d_u,d_v)}{min(d_u,d_v)}\right\}$ which helps in heat transformation and determining total surface area of some chemical compounds.

Theorem13.1: Symmetric division index of Vitamin C is **30.3333.**

Proof: $SSD(\text{Vitamin C}) = \sum_{e=uv\in E(G)}\left\{\frac{\min(d_u,d_v)}{\max(d_u,d_v)} + \frac{\max(d_u,d_v)}{\min(d_u,d_v)}\right\}$

$$= |E_{1,2}|\left\{\frac{\min(1,2)}{\max(1,2)} + \frac{\max(1,2)}{\min(1,2)}\right\} |E_{1,3}|\left\{\frac{\min(1,3)}{\max(1,3)} + \frac{\max(1,3)}{\min(1,3)}\right\} +$$

$$|E_{2,3}|\left\{\frac{\min(2,3)}{\max(2,3)} + \frac{\max(2,3)}{\min(2,3)}\right\} + |E_{3,3}|\left\{\frac{\min(3,3)}{\max(3,3)} + \frac{\max(3,3)}{\min(3,3)}\right\}$$

$SSD(\text{Vitamin C}) = 30.3333.$

III. Application of topological indices of Vitamin C

Topological indices can be applied to vitamin C (ascorbic acid) in various ways, particularly in the fields of cheminformatics, medicinal chemistry, and biochemistry. Here are some key applications:

Predicting Biological Activity: Topological indices can help predict the biological activity of vitamin C and its derivatives. By comparing these indices with those of other compounds, researchers can identify potential pharmacological properties and efficacy.

Structure-Activity Relationship (SAR) Studies: In medicinal chemistry, topological indices can be used to establish correlations between molecular structure and biological activity. This helps in designing new compounds based on the structural features of vitamin C.

Drug Design and Development: Topological indices can assist in virtual screening processes by identifying structural characteristics that are associated with desirable pharmacokinetic properties, such as solubility and permeability.

Chemical Stability Assessment: By analyzing the topological indices, researchers can infer the stability of vitamin C in various conditions. This is important for formulating products that maintain efficacy over time.

Quantitative Structure-Activity Relationship (QSAR) Models: Topological indices can be integrated into QSAR models to quantitatively predict the biological effects and toxicity of vitamin C-related compounds, aiding in the risk assessment of new formulations.

Comparative Analysis: Researchers can use topological indices to compare vitamin C with other antioxidants or related compounds, which can provide insights into their relative efficacy and mechanisms of action.

Molecular Visualization: Topological indices can aid in the visualization of the molecular structure of vitamin C, helping scientists understand its conformational features and interactions with biological targets.

By utilizing topological indices, researchers can gain a deeper understanding of vitamin C's properties and potential applications, paving the way for innovative research and development in health and nutrition.

IV. CONCLUSION:

In this article we have computed some topological indices like ABC index, Randic connectivity index, Sum connectivity index, GA index, GA_5 index, First Zagreb index, Second Zagreb index, first multiple Zagreb index, Second multiple Zagreb index, Augmented Zagreb index, Harmonic index and Hyper Zagreb index of Vitamin C. And, we have computed some polynomials like First Zagreb polynomial, Second Zagreb polynomial, Third Zagreb polynomial, forgotten polynomial, Forgotten topological index, and symmetric division index of Vitamin C.

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