South East Asian J. of Mathematics and Mathematical Sciences
Vol. 17, No. 3 (2021), pp. 285-298

ISSN (Online): 2582-0850

ISSN (Print): 0972-7752

ADRIATIC INDICES OF SOME DERIVED GRAPHS OF TRIGLYCERIDE

V. Lokesha, M. Manjunath*, T. Deepika¶, A. S. Cevik†, I. N. Cangul§

Department of Studies in Mathematics,
Vijayanagara Sri Krishnadevaraya University,
Ballari - 583105, Karnataka, INDIA

E-mail : v.lokesha@gmail.com

*Department of Mathematics,
Ballari Institute of Technology and Management,
Ballari, Karnataka - 583105, INDIA

E-mail : manju3479@gmail.com

¶Department of Mathematics, School of Engineering,
Dayananda Sagar University, Bangalore, Karnataka - 560068, INDIA

E-mail : sastry.deepi@gmail.com

†Department of Mathematics,
Faculty of Science, Selcuk University 42075 Konya, TURKEY

E-mail : sinan.cevik@selcuk.edu.tr

§Department of Mathematics,
Bursa Uludag University 16059 Bursa, TURKEY

E-mail : cangul@uludag.edu.tr

(**Received:** *Jan. 24, 2021* **Accepted:** *Oct. 16, 2021* **Published:** *Dec. 30, 2021)*

Abstract: Topological indices are graph invariants used for quantitative structure-activity relationship (QSAR) and quantitative structure-property relationship (Q SPR) in molecular chemistry. Esters are a class of organic compounds which are mostly fragrant and can be represented by the formula RCOOR. They are usually formed by the reaction between an acid and an alcohol with elimination of water. Triglyceride is an ester formed by three fatty acids to obtain a single glycerol molecule. Topological graph indices are some mathematical formulae defined and used to determine some structural properties of the molecules. Discrete Adriatic indices are the family of 148 bond-additive topological graph indices. In this article, we compute nine of these indices for the total graph, subdivision graph, additional vertex subdivision graph and additional edge subdivision graph of triglyceride.

Keywords and Phrases: Topological graph indices, topological indices, Adriatic indices, triglyceride, chemical graph, derived graph.

2020 Mathematics Subject Classification: 05C92, 05C30, 92E10.

1. Introduction

A topological graph index of a chemical graph G is a numeric quantity attributed to G. The topological graph indices are graph invariants used for quantitative structure-activity relationship (QSAR) and quantitative structure-property relationship (QSPR). By means of carefully defined topological graph indices, we can obtain the physical and chemical properties of a molecule without any time and money consuming experiments. To do this, we have to model the molecule by a graph so that the atoms of the molecule are represented by the vertices and the chemical bonds are represented by the edges of the graph. After this modelling, we have an exact replica of the molecule on which we can do some algebraic calculations to obtain the required scientific information combinatorically.

Usage of topological indices in chemistry began in 1947 when chemist H. Wiener, [10], developed the widely known topological descriptor, the Wiener index, and used it to determine the boiling points, a physical property of alkanes forming a class of paraffins. In [1], the entire Zagreb indices of graphs have been considered.

Discrete Adriatic indices are the family of 148 bond-additive topological indices which were scrutinized on the testing sets provided by the International Academy of Mathematical Chemistry ($IAMC$), [9]. It has been exhibited that they have good predictive properties in many cases. There has been an intensive research related to topological indices and their properties. A recent problem which is called the inverse problem deals with what integer values can a given topological graph index attend. In [11], two of the authors solved this problem completely for Zagreb indices. With a similar manner, in [7], the authors investigated Randic, atom bound connectivity, geometric arithmetic, Zagreb, Multiplicative Zagreb, redefined Zagreb indices and Zagreb coindices for line graph of first organic network $L(MON_1(\chi))$ and second organic network $L(MON_2(\chi))$, where $\chi \geq 2$. Also in [8], it has been presented some renowned topological co-indices, namely first and second Zagreb co-indices, first and second multiplicative Zagreb co-indices and the F-coindex, and some other degree-based indices of the co-indices of ceria oxide.

Inverse sum indeg index is a recently introduced bond-additive descriptor that was selected by Vukicevic and Gasperov, [9], in 2010 as a significant predictor of total surface area of octane isomers. Symmetric division deg index is a good predictor of total surface area for polychlorobiphenyls. Inspired from the success of these indices, the augmented zagreb index is shown to be useful for computing the heat of formation of alkanes. The so-called sum-connectivity index is a recent invention and basic properties of it were established in [2]. Misblance rodeg index is a significant predictor of enthalpy of vaporisation and of standard enthalpy of vaporisation for octane isomers. For the definitions of the indices used in this study, refer to Table 1.

Triglycerides are a type of fat (lipid) found in blood, see Fig. 1. After eating, the body converts any excess calories which are not used right away into triglycerides. The triglycerides are stored in fat cells. Triglycerides are fats, and they are used to produce the energy of a cell called adenosine triphosphate (ATP). When energy is needed by cells, the fat is removed and sent to cells via cholesterol transport. Triglycerides are also used in the cell membrane to control permeability of the cell. If you regularly consume more calories than you burn, particularly "easy" calories like carbohydrates and fats, you may have high triglycerides, [5], called hypertriglyceridemia. However, high triglyceride levels increase the risk of heart disease according to the American Heart Association.

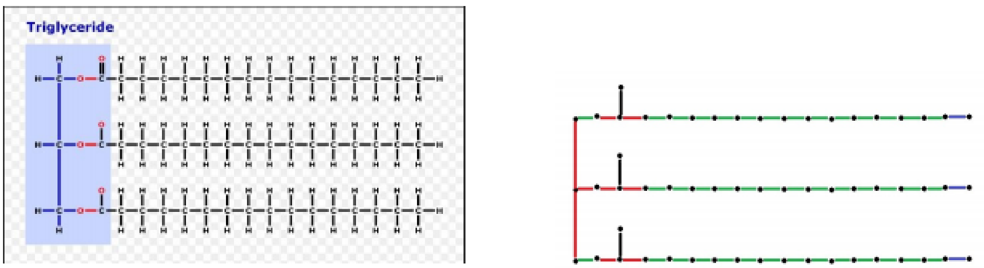


Figure 1: Triglyceride and carbon graph of triglyceride

Triglyceride fatty acid tails can have saturated or unsaturated form. Saturated fatty acid tails are all single bond carbons. This means that for each carbon, there are two hydrogens and two carbons attached. There are no double bonds in a saturated molecule. Unsaturated fatty acids have at least one double bond. Single bond molecules are called mono saturated. A molecule that contains more than one double bonds is called polyunsaturated. Here we consider carbon atoms in saturated fatty acids.

This article is organized in three sections. In Section 1, the preliminary notions are recalled. In Section 2, the main results of the paper are given. In the final Section, the conclusions of this paper are discussed. First we recall some necessary notions:

Definition 1.1. [3] *The total graph $T(G)$ of a graph G is the graph whose vertex set is $V \cup E$, with two vertices of $T(G)$ being adjacent if and only if the corresponding elements of G are adjacent or incident.*

Definition 1.2. [4] *Let G be a graph. Additional vertex subdivision graph $R(G)$ is defined as the graph obtained from G by adding a new vertex to $V(G)$ for each edge of G and by joining such each new vertex to the end vertices of the edge corresponding to it.*

Definition 1.3. [4] *Let G be a graph. Additional edge subdivision graph $Q(G)$ is defined as the graph obtained from G by adding a new vertex to $V(G)$ for each edge of G and by joining those pairs of new vertices which correspond to adjacent edges of G by a new edge.*

Definition 1.4. [2] *Let G be a graph. The subdivision graph $S(G)$ of G is obtained from G by adding a new vertex onto each edge of G. Another way of obtaining $S(G)$ is replacing each edge of G by a path of length 2.*

Lemma 1.1. [6] *Let G be a graph with n vertices and m edges. Then $R(G)$ has $n + m$ vertices and $3m$ edges.*

Let G be a graph and d_u be the degree of a vertex $u \in V(G)$. Some well known Adriatic indices are listed in Table 1.

Name of index	**Definition**
Inverse sum indeg index	$ISI(G) = \sum_{uv \in E(G)} \frac{d_u d_v}{d_u + d_v}$
Augmented zagreb index	$AZI(G) = \sum_{uv \in E(G)} \left[\frac{d_u d_v}{d_u + d_v - 2} \right]^3$
Symmetric Division degree index	$SDD(G) = \sum_{uv \in E(G)} \frac{d_u^2 + d_v^2}{d_u d_v}$
Harmonic index	$H(G) = \sum_{uv \in E(G)} \frac{2}{d_u + d_v}$
Sum-Connectivity index	$SCI(G) = \sum_{uv \in E(G)} \frac{1}{\sqrt{d_u + d_v}}$
Misbalance deg index	$MD(G) = \sum_{uv \in E(G)} \mid d_u - d_v \mid$
Misbalance rodeg index	$MRD(G) = \sum_{uv \in E(G)} \mid \sqrt{d_u} - \sqrt{d_v} \mid$
Misbalance irdeg index	$MIRD(G) = \sum_{uv \in E(G)} \mid \frac{1}{\sqrt{d_u}} - \frac{1}{\sqrt{d_v}} \mid$
Misbalance haddeg index	$MHD(G) = \sum_{uv \in E(G)} \mid 2^{-d_u} - 2^{-d_v} \mid$

Table 1: Some well known Adriatic indices

2. Main Results

In this section, we obtain some results on 9 Adriatic indices for the total graph, subdivision graph and additional vertex and additional edge subdivision graphs of triglyceride graph.

Theorem 2.1. *Let G be the total graph of triglyceride. Then*

$$\begin{array}{ccc} ISI[G]=464.12, & AZI[G]=31415.57547, & SDD[G]=465.4, \\ H[G]=55.7395, & SCI[G]=79.3898, & MD[G]=88, \\ MRD[G]=21.6899, & MIRD[G]=5.6056, & MHD[G]=3.9688. \end{array}$$

Proof. Suppose the graph G is the total graph of triglyceride. It consists of nine different types of edges as indicated in Table 2.

A	(2,3)	(2,4)	(2,6)	(3,4)	(4,4)	(4,5)	(4,6)	(5,5)	(5,6)
B	3	6	3	6	159	22	12	7	9

Table 2: The edge partition of the total graph of triglyceride where A denotes the type of edges (d_u, d_v) with $uv \in E(G)$ and B is the number of edges.

Utilizing these, we obtain the related indices as follows:

$$\begin{aligned} ISI[G] &= 3\left[\frac{2.3}{2+3}\right]+6\left[\frac{2.4}{2+4}\right]+3\left[\frac{2.6}{2+6}\right]+6\left[\frac{3.4}{3+4}\right]+159\left[\frac{4.4}{4+4}\right] \\ &\quad +22\left[\frac{4.5}{4+5}\right]+12\left[\frac{4.6}{4+6}\right]+7\left[\frac{5.5}{5+5}\right]+9\left[\frac{5.6}{5+6}\right] \\ &= 464.12, \end{aligned}$$

$$\begin{aligned} AZI[G] &= 3\left[\frac{2.3}{2+3-2}\right]^3+6\left[\frac{2.4}{2+4-2}\right]^3+3\left[\frac{2.6}{2+6-2}\right]^3+6\left[\frac{3.4}{3+4-2}\right]^3+ \\ &\quad 159\left[\frac{4.4}{4+4-2}\right]^3+22\left[\frac{4.5}{4+5-2}\right]^3+12\left[\frac{4.6}{4+6-2}\right]^3+7\left[\frac{5.5}{5+5-2}\right]^3+ \\ &\quad 9\left[\frac{5.6}{5+6-2}\right]^3 \\ &= 31415.57547, \end{aligned}$$

$$\begin{aligned}
SDD[G] &= 3\left[\frac{2^2+3^2}{2.3}\right]+6\left[\frac{2^2+4^2}{2.4}\right]+3\left[\frac{2^2+6^2}{2.6}\right]+6\left[\frac{3^2+4^2}{3.4}\right]+159\left[\frac{4^2+4^2}{4.4}\right]\\
&\quad +22\left[\frac{4^2+5^2}{4.5}\right]+12\left[\frac{4^2+6^2}{4.6}\right]+7\left[\frac{5^2+5^2}{5.5}\right]+9\left[\frac{5^2+6^2}{5.6}\right]\\
&= 465.4,
\end{aligned}$$

$$\begin{aligned}
H[G] &= 3\left[\frac{2}{2+3}\right]+6\left[\frac{2}{2+4}\right]+3\left[\frac{2}{2+6}\right]+6\left[\frac{2}{3+4}\right]+159\left[\frac{2}{4+4}\right]\\
&\quad +22\left[\frac{2}{4+5}\right]+12\left[\frac{2}{4+6}\right]+7\left[\frac{2}{5+5}\right]+9\left[\frac{2}{5+6}\right]\\
&= 55.7395,
\end{aligned}$$

$$\begin{aligned}
SCI[G] &= 3\left[\frac{1}{\sqrt{2+3}}\right]+6\left[\frac{1}{\sqrt{2+4}}\right]+3\left[\frac{1}{\sqrt{2+6}}\right]+6\left[\frac{1}{\sqrt{3+4}}\right]+159\left[\frac{1}{\sqrt{4+4}}\right]\\
&\quad +22\left[\frac{1}{\sqrt{4+5}}\right]+12\left[\frac{1}{\sqrt{4+6}}\right]+7\left[\frac{1}{\sqrt{5+5}}\right]+9\left[\frac{1}{\sqrt{5+6}}\right]\\
&= 79.3898,
\end{aligned}$$

$$\begin{aligned}
MD[G] &= 3|2-3|+6|2-4|+3|2-6|+6|3-4|+159|4-4|\\
&\quad +22|4-5|+12|4-6|+7|5-5|+9|5-6|\\
&= 88,
\end{aligned}$$

$$\begin{aligned}
MRD[G] &= 3|\sqrt{2}-\sqrt{3}|+6|\sqrt{2}-\sqrt{4}|+3|\sqrt{2}-\sqrt{6}|+6|\sqrt{3}-\sqrt{4}|+159|\sqrt{4}-\sqrt{4}|\\
&\quad +22|\sqrt{4}-\sqrt{5}|+12|\sqrt{4}-\sqrt{6}|+7|\sqrt{5}-\sqrt{5}|+9|\sqrt{5}-\sqrt{6}|\\
&= 21.6899,
\end{aligned}$$

$$\begin{aligned}
MIRD[G] &= 3\left|\frac{1}{\sqrt{2}}-\frac{1}{\sqrt{3}}\right|+6\left|\frac{1}{\sqrt{2}}-\frac{1}{\sqrt{4}}\right|+3\left|\frac{1}{\sqrt{2}}-\frac{1}{\sqrt{6}}\right|+6\left|\frac{1}{\sqrt{3}}-\frac{1}{\sqrt{4}}\right|+159\left|\frac{1}{\sqrt{4}}\right.\\
&\quad \left.-\frac{1}{\sqrt{4}}\right|+22\left|\frac{1}{\sqrt{4}}-\frac{1}{\sqrt{5}}\right|+12\left|\frac{1}{\sqrt{4}}-\frac{1}{\sqrt{6}}\right|+7\left|\frac{1}{\sqrt{5}}-\frac{1}{\sqrt{5}}\right|+9\left|\frac{1}{\sqrt{5}}-\frac{1}{\sqrt{6}}\right|\\
&= 5.6056,
\end{aligned}$$

$$\begin{aligned} MHD[G] &= 3|2^{-2}-2^{-3}|+6|2^{-2}-2^{-4}|+3|2^{-2}-2^{-6}|+6|2^{-3}-2^{-4}|+159|2^{-4} \\ &\quad -2^{-4}|+22|2^{-4}-2^{-5}|+12|2^{-4}-2^{-6}|+7|2^{-5}-2^{-5}|+9|2^{-5}-2^{-6}| \\ &= 3.9688. \end{aligned}$$

Hence the result.

Theorem 2.2. *Let G be the additional vertex subdivision graph of triglyceride. Then*

$$\begin{array}{ccc} ISI[G]=112.4, & AZI[G]=840.5, & SDD[G]=229, \\ H[G]=55.8, & SCI[G]=55.83066476, & MD[G]=18, \\ MRD[G]=6.299328317, & MIRD[G]=3.314437457, & MHD[G]=3. \end{array}$$

Proof. Suppose G be the additional vertex subdivision graph of triglyceride. It has three different types of edges as indicated in Table 3.

A	(1,2)	(2,2)	(2,3)
B	6	94	12

Table 3: The edge partition of the additional vertex subdivision graph of triglyceride, where A denotes the type of edges (d_u, d_v) with $uv \in E(G)$ and B is the number of edges.

Utilizing these, we obtain the required indices as follows:

$$\begin{aligned} ISI[G] &= 6\left[\frac{1.2}{1+2}\right]+94\left[\frac{2.2}{2+2}\right]+12\left[\frac{2.3}{2+3}\right] \\ &= 112.4, \end{aligned}$$

$$\begin{aligned} AZI[G] &= 6\left[\frac{1.2}{1+2-2}\right]^3+94\left[\frac{2.2}{2+2-2}\right]^3+12\left[\frac{1.3}{1+3-2}\right]^3 \\ &= 840.5, \end{aligned}$$

$$\begin{aligned} SDD[G] &= 6\left[\frac{1^2+2^2}{1.2}\right]+94\left[\frac{2^2+2^2}{2.2}\right]+12\left[\frac{2^2+3^2}{2.3}\right] \\ &= 229, \end{aligned}$$

$$\begin{aligned} H[G] &= 6\left[\frac{2}{1+2}\right]+94\left[\frac{2}{2+2}\right]+12\left[\frac{2}{2+3}\right] \\ &= 55.8, \end{aligned}$$

$$\begin{aligned} SCI[G] &= 6\left[\frac{1}{\sqrt{1+2}}\right] + 94\left[\frac{1}{\sqrt{2+2}}\right] + 12\left[\frac{1}{\sqrt{2+3}}\right] \\ &= 55.83066476, \end{aligned}$$

$$\begin{aligned} MD[G] &= 6|1-2| + 94|2-2| + 12|2-3| \\ &= 18, \end{aligned}$$

$$\begin{aligned} MRD[G] &= 6|\sqrt{2}-\sqrt{1}| + 94|\sqrt{2}-\sqrt{2}| + 12|\sqrt{3}-\sqrt{2}| \\ &= 6.299328317, \end{aligned}$$

$$\begin{aligned} MIRD[G] &= 6\left|\frac{1}{\sqrt{1}} - \frac{1}{\sqrt{2}}\right| + 94\left|\frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}}\right| + 12\left|\frac{1}{\sqrt{2}} - \frac{1}{\sqrt{3}}\right| \\ &= 3.314437457, \end{aligned}$$

$$\begin{aligned} MHD[G] &= 6|2^{-1} - 2^{-2}| + 94|2^{-2} - 2^{-2}| + 12|2^{-2} - 2^{-3}| \\ &= 3. \end{aligned}$$

Hence the result.

Theorem 2.3. *Let G be the additional edge subdivision graph of triglyceride. Then*

$$\begin{array}{ccc} ISI[G] = 261.4333333, & AZI[G] = 1964.481481, & SDD[G] = 406. \\ H[G] = 51.13333333, & SCI[G] = 65.24512394, & MD[G] = 272. \\ MRD[G] = 76.39583484, & MIRD[G] = 25.39800052, & MHD[G] = 22.125. \end{array}$$

Proof. Suppose that the graph G is the additional edge subdivision graph of triglyceride which consists of five different types of edges as indicated in Table 4.

A	(2,2)	(2,4)	(2,6)	(4,4)	(4,6)
B	6	97	15	41	9

Table 4: The edge partition of additional edge subdivision graph of triglyceride where A denotes the type of edges (d_u, d_v) with $uv \in E(G)$ and B is the number of edges.

Utilizing these values, we obtain the related indices as follows:

$$\begin{aligned} ISI[G] &= 6\left[\frac{2.2}{2+2}\right] + 15\left[\frac{2.6}{2+6}\right] + 97\left[\frac{2.4}{2+4}\right] + 41\left[\frac{4.4}{4+4}\right] + 9\left[\frac{4.6}{4+6}\right] \\ &= 261.4333333, \end{aligned}$$

$$\begin{aligned} AZI[G] &= 6\left[\frac{2.2}{2+2-2}\right]^3 + 15\left[\frac{2.6}{2+6-2}\right]^3 + 97\left[\frac{2.4}{2+4-2}\right]^3 + 41\left[\frac{4.4}{4+4-2}\right]^3 + \\ &\quad 9\left[\frac{4.6}{4+6-2}\right]^3 \\ &= 1964.481481, \end{aligned}$$

$$\begin{aligned} SDD[G] &= 6\left[\frac{2^2+2^2}{2.2}\right] + 15\left[\frac{2^2+6^2}{2.6}\right] + 97\left[\frac{2^2+4^2}{2.4}\right] + 41\left[\frac{4^2+4^2}{4.4}\right] + 9\left[\frac{4^2+6^2}{4.6}\right] \\ &= 406, \end{aligned}$$

$$\begin{aligned} H[G] &= 6\left[\frac{2}{2+2}\right] + 15\left[\frac{2}{2+6}\right] + 97\left[\frac{2}{2+4}\right] + 41\left[\frac{2}{4+4}\right] + 9\left[\frac{2}{4+6}\right] \\ &= 51.13333333, \end{aligned}$$

$$\begin{aligned} SCI[G] &= 6\left[\frac{1}{\sqrt{2+2}}\right] + 15\left[\frac{1}{\sqrt{2+6}}\right] + 97\left[\frac{1}{\sqrt{2+4}}\right] + 41\left[\frac{1}{\sqrt{4+4}}\right] + \\ &\quad 9\left[\frac{1}{\sqrt{4+6}}\right] \\ &= 65.24512394, \end{aligned}$$

$$\begin{aligned} MD[G] &= 6|2-2| + 15|2-6| + 97|2-4| + 41|4-4| + 9|4-6| \\ &= 272, \end{aligned}$$

$$\begin{aligned} MRD[G] &= 6|\sqrt{2}-\sqrt{2}| + 15|\sqrt{6}-\sqrt{2}| + 97|\sqrt{4}-\sqrt{2}| + 41|\sqrt{4}-\sqrt{4}| + \\ &\quad 9|\sqrt{6}-\sqrt{4}| \\ &= 76.39583484, \end{aligned}$$

$$\begin{aligned} MIRD[G] &= 6\left|\frac{1}{\sqrt{2}}-\frac{1}{\sqrt{2}}\right| + 15\left|\frac{1}{\sqrt{2}}-\frac{1}{\sqrt{6}}\right| + 97\left|\frac{1}{\sqrt{2}}-\frac{1}{\sqrt{4}}\right| + 41\left|\frac{1}{\sqrt{4}}-\frac{1}{\sqrt{4}}\right| + \\ &\quad 9\left|\frac{1}{\sqrt{4}}-\frac{1}{\sqrt{6}}\right| \\ &= 25.39800052, \end{aligned}$$

$$\begin{aligned} MHD[G] &= 6|2^{-2}-2^{-2}| + 15|2^{-2}-2^{-6}| + 97|2^{-2}-2^{-4}| + 41|2^{-4}-2^{-4}| + \\ &\quad 9|2^{-4}-2^{-6}| \\ &= 22.125. \end{aligned}$$

This completes the proof.

Theorem 2.4. *Let G be the subdivision graph of triglyceride. Then*

$$\begin{array}{ccc} ISI[G] = 279.4781746, & AZI[G] = 2135.073013, & SDD[G] = 402.7333333\,, \\ H[G] = 51.12460317, & SCI[G] = 65.65375204, & MD[G] = 242\,, \\ MRD[G] = 69.84930326, & MIRD[G] = 24.58942278, & MHD[G] = 21.65625\,. \end{array}$$

Proof. The subdivision graph of triglyceride consists of ten different types of edges given in Table 5.

A	(1,3)	(1,4)	(2,3)	(2,4)	(2,5)	(3,4)	(3,5)	(4,4)	(4,5)	(5,5)
B	3	3	3	84	7	8	7	38	13	4

Table 5: The edge partition of subdivision graph of triglyceride where A denotes the type of edges (d_u, d_v) with $uv \in E(G)$ and B is the number of edges.

Utilizing these values, we obtain the related indices as follows.

$$\begin{aligned} ISI[G] &= 3\left[\frac{1.3}{1+3}\right] + 3\left[\frac{1.4}{1+4}\right] + 3\left[\frac{2.3}{2+3}\right] + 84\left[\frac{2.4}{2+4}\right] + 7\left[\frac{2.5}{2+5}\right] \\ &\quad +7\left[\frac{3.5}{3+5}\right] + 8\left[\frac{3.4}{3+4}\right] + 38\left[\frac{4.4}{4+4}\right] + 13\left[\frac{4.5}{4+5}\right] + 4\left[\frac{5.5}{5+5}\right] \\ &= 279.4781746, \end{aligned}$$

$$\begin{aligned} AZI[G] &= 3\left[\frac{1.3}{1+3-2}\right]^3 + 3\left[\frac{1.4}{1+4-2}\right]^3 + 3\left[\frac{2.3}{2+3-2}\right]^3 + 84\left[\frac{2.4}{2+4-2}\right]^3 + \\ &\quad 7\left[\frac{2.5}{2+5-2}\right]^3 + 7\left[\frac{3.5}{3+5-2}\right]^3 + 8\left[\frac{3.4}{3+4-2}\right]^3 + 38\left[\frac{4.4}{4+4-2}\right]^3 + \\ &\quad 13\left[\frac{4.5}{4+5-2}\right]^3 + 4\left[\frac{5.5}{5+5-2}\right]^3 \\ &= 2135.073013, \end{aligned}$$

$$\begin{aligned} SDD[G] &= 3\left[\frac{1^2+3^2}{1.3}\right] + 3\left[\frac{1^2+4^2}{1.4}\right] + 3\left[\frac{2^2+3^2}{2.3}\right] + 84\left[\frac{2^2+4^2}{2.4}\right] + \\ &\quad 7\left[\frac{2^2+5^2}{2.5}\right] + 7\left[\frac{3^2+5^2}{3.5}\right] + 8\left[\frac{3^2+4^2}{3.4}\right] + 38\left[\frac{4^2+4^2}{4.4}\right] + \\ &\quad 13\left[\frac{4^2+5^2}{4.5}\right] + 4\left[\frac{5^2+5^2}{5.5}\right] \\ &= 402.733333, \end{aligned}$$

$$\begin{aligned} H[G] &= 3\left[\frac{2}{1+3}\right]+3\left[\frac{2}{1+4}\right]+3\left[\frac{2}{2+3}\right]+84\left[\frac{2}{2+4}\right]+7\left[\frac{2}{2+5}\right] \\ &\quad +7\left[\frac{2}{3+5}\right]+8\left[\frac{2}{3+4}\right]+38\left[\frac{2}{4+4}\right]+13\left[\frac{2}{4+5}\right]+4\left[\frac{2}{5+5}\right] \\ &= 51.12460317, \end{aligned}$$

$$\begin{aligned} SCI[G] &= 3\left[\frac{1}{\sqrt{1+3}}\right]+3\left[\frac{1}{\sqrt{1+4}}\right]+3\left[\frac{1}{\sqrt{2+3}}\right]+84\left[\frac{1}{\sqrt{2+4}}\right]+7\left[\frac{1}{\sqrt{2+5}}\right] \\ &\quad +7\left[\frac{1}{\sqrt{3+5}}\right]+8\left[\frac{1}{\sqrt{3+4}}\right]+38\left[\frac{1}{\sqrt{4+4}}\right]+13\left[\frac{1}{\sqrt{4+5}}\right]+4\left[\frac{1}{\sqrt{5+5}}\right] \\ &= 65.65375204, \end{aligned}$$

$$\begin{aligned} MD[G] &= 3|1-3|+3|1-4|+3|2-3|+84|2-4|+7|2-5|+7|3-5|+8|3-4|+ \\ &\quad 38|4-4|+13|4-5|+4|5-5| \\ &= 242. \end{aligned}$$

$$\begin{aligned} MRD[G] &= 3|\sqrt{1}-\sqrt{3}|+3|\sqrt{1}-\sqrt{4}|+3|\sqrt{2}-\sqrt{3}|+84|\sqrt{2}-\sqrt{4}|+7|\sqrt{2}-\sqrt{5}| \\ &\quad +7|\sqrt{3}-\sqrt{5}|+8|\sqrt{3}-\sqrt{4}|+38|\sqrt{4}-\sqrt{4}|+13|\sqrt{4}-\sqrt{5}|+4|\sqrt{5}-\sqrt{5}| \\ &= 69.84930326, \end{aligned}$$

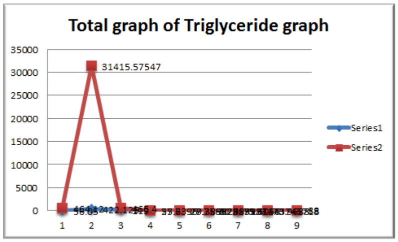
$$\begin{aligned} MIRD[G] &= 3\left|\frac{1}{\sqrt{1}}-\frac{1}{\sqrt{3}}\right|+3\left|\frac{1}{\sqrt{1}}-\frac{1}{\sqrt{4}}\right|+3\left|\frac{1}{\sqrt{2}}-\frac{1}{\sqrt{3}}\right|+84\left|\frac{1}{\sqrt{2}}-\frac{1}{\sqrt{4}}\right|+7\left|\frac{1}{\sqrt{2}}-\frac{1}{\sqrt{5}}\right| \\ &\quad +7\left|\frac{1}{\sqrt{3}}-\frac{1}{\sqrt{5}}\right|+8\left|\frac{1}{\sqrt{3}}-\frac{1}{\sqrt{4}}\right|+38\left|\frac{1}{\sqrt{4}}-\frac{1}{\sqrt{4}}\right|+13\left|\frac{1}{\sqrt{4}}-\frac{1}{\sqrt{5}}\right|+ \\ &\quad 4\left|\frac{1}{\sqrt{5}}-\frac{1}{\sqrt{5}}\right| \\ &= 24.58942278, \end{aligned}$$

$$\begin{aligned} MHD[G] &= 3|2^{-1}-2^{-3}|+3|2^{-1}-2^{-4}|+3|2^{-2}-2^{-3}|+84|2^{-2}-2^{-4}|+7|2^{-2}-2^{-5}| \\ &\quad +7|2^{-3}-2^{-5}|+8|2^{-3}-2^{-4}|+13|2^{-4}-2^{-5}|+38|2^{-4}-2^{-4}|+4|2^{-5}-2^{-5}| \\ &= 21.65625. \end{aligned}$$

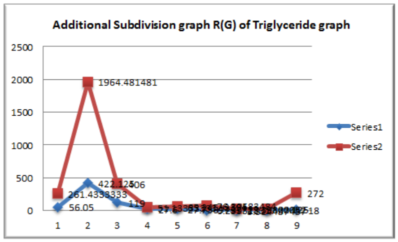
Hence the result.

3. Conclusion

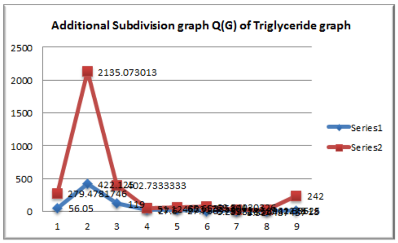
In this paper, we combinatorically calculated and compared some of the discrete Adriatic indices. In Figure 2-(a),(b),(c) and (d), "Series1" indicates the values of the nine Adriatic graph indices of triglyceride molecule itself, and "Series2" indicates the values of graph indices of $T(G), R(G)$, $Q(G)$ and $S(G)$, respectively. In this regard, it is shown that the augmented Zagreb index is highly elevated in all cases and the rest of the indices are taking very approximate values to triglyceride molecule.



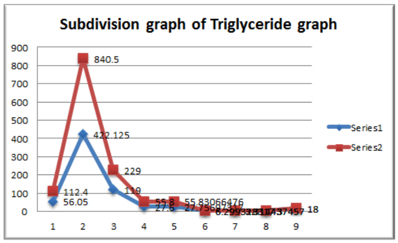
(a)



(b)



(c)



(d)

Figure 2: Comparison of the graph indices of the derived graphs of triglyceride

References

[1] Alwardi, A., Alqesmah, A., Rangarajan, R., Cangul, I. N., Entire Zagreb indices of graphs, Discrete Mathematics, Algorithms and Applications, 10(3) (2018), 1850037 (16 pages) DOI: 10.1142/S1793830918500374.

[2] Bindusree, A. R., Lokesha, V. and Ranjini, P. S., ABC index on subdivision graphs and line graphs, IOSR Journal of Mathematics, 12 (2016), 1-6.

[3] Cvetkovic, D. M., Spectrum of the total graph of a graph, Publications de L'Institut Mathematique, 16(30) (1973), 49-52.

[4] Cvetkovic, D. M., Doob M. and Sachs H., Spectra of Graphs-Theory and Application, Academic Press, New York, (1980).

[5] Kanna, M. R., Mamta, D. and Indumathi, R. S., Computation of Topological Indices of Triglycride, Global Journal of Pure and Applied Mathematics, 13(6) (2017), 1631-1638.

[6] Ranjini P. S., Lokesha, V. and Smarandache, Zagreb index on three graph operators, Mathematical Combinatorics Book Ser., 3 (2010), 1-10.

[7] Nadeem M. F., Imran M., Siddiqui, H. M. A., Azeem M., Khalil A. and Yasir A., Topological aspects of metal-organic structure with the help of underlying networks, Arabian Journal of Chemistry, 14(6) (2021), 103157.

[8] Siddiqui, M. K., Chu Y-C., Nasir M., Nadeem M. F. and Hanif M. F., On topological descriptors of ceria oxide and their applications, Main Group Metal Chemistry, 44(1) (2021), 103-116.

[9] Vukicevic, D. and Gasperov, M., Bond Additive Modeling 1. Adriatic Indices, Croatica Chemica Acta, 83(3) (2010), 243-260.

[10] Wiener, H., Structural Determination of Paraffin Boiling Points, J. Am. Chem. Soc., 69(1) (1947), 17–20.

[11] Yurttas, A., Togan, M., Lokesha, V., Cangul, I. N., Gutman, I., Inverse problem for Zagreb indices, J Math Chem, 56 (2018), 1-7.