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Research Article

Multiplicative Valency-Based Descriptors for Silicon Carbides $Si_2C_3 - I[p, q]$, $Si_2C_3 - II[p, q]$, $Si_2C_3 - III[p, q]$, and $SiC_3 - III[p, q]$ in Drug Applications

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Topological indices help us to collect information about algebraic graphs and give us a mathematical approach to understand the properties of algebraic structures. In literature, there are more than 148 topological indices, but none of them can completely describe all properties of chemical compounds. Together, they do it to some extent, so there is always room to define new topological indices. In this paper, we introduced the multiplicative version of Shingali and Kanabour indices and computed these indices for Silicon Carbides $Si_2C_3 - I[p, q]$, $Si_2C_3 - II[p, q]$, $Si_2C_3 - III[p, q]$, and $SiC_3 - III[p, q]$.

1. Introduction

In discrete mathematics, graph theory is not only the study of different properties of objects, but it also tells us about objects having the same properties as investigating objects [1]. These properties of different objects are of main interest. In particular, graph polynomials related to graph are rich in information. Mathematical tools like polynomials and topological based numbers have significant importance in collecting information about the properties of chemical compounds. We can find out much hidden information about compounds through these tools [2].

Actually, topological indices are numeric quantities that tell us about the whole structure of graph. There are many topological indices that help us to study physical, chemical reactivities, and biological properties [3–5]. Wiener, in 1947, firstly introduced the concept of the topological index while working on a boiling point [6]. In particular, Hosoya polynomial [7] plays an important role in the area of distance-based topological indices; we can find out Wiener index, hyper-Wiener index, and Tratch-stankevich-zefirove index by Hosoya polynomial [8]. In the whole paper, we take d_u a degree of vertex u which is equal to the number of vertices that are at a distance one from u.

Gutman and Trinajstić introduced the first and second Zagreb indices, which are defined as follows:

$$M_1(G) = \sum_{uv \in E(G)} (d_u + d_v),$$
$$M_2(G) = \sum_{uv \in E(G)} (d_u \times d_v), \tag{1}$$

respectively. Further details about these indices can be found in reference [9].

The modified Randić index is defined as follows:

$$R'(G) = \frac{1}{\max\{d_u, d_v\}}. \tag{2}$$

Shigehalli and Kanabur [9] introduced the following new degree-based topological indices. Arithmetic-Geometric index is defined as follows:

$$\mathrm{AG}_1 = \sum_{uv\in E(G)} \frac{d_u + d_v}{2\sqrt{d_u \times d_v}}. \tag{3}$$

Shigehalli and Kanabur indices are defined as follows:

$$\begin{aligned} \mathrm{SK}(G) &= \frac{d_u + d_v}{2}, \\ \mathrm{SK}_1(G) &= \frac{d_u \times d_v}{2}, \\ \mathrm{SK}_2(G) &= \left(\frac{d_u + d_v}{2}\right)^2. \end{aligned} \tag{4}$$

Our aim is to introduce the multiplicative version of Shigehalli and Kanabur indices and modify the Randić index. The multiplicative modified Randić index is defined as follows:

$$\mathrm{MR}'(G) = \prod_{uv\in E(G)} \frac{1}{\max\{d_u, d_v\}}. \tag{5}$$

The multiplicative version of Shigehalli and Kanabur indices and multiplicative Arithmetic-Geometric index are defined as follows:

$$\begin{aligned} \mathrm{MAG}_1 &= \prod_{uv\in E(G)} \frac{d_u + d_v}{2\sqrt{d_u \times d_v}}, \\ \mathrm{MSK}(G) &= \prod_{uv\in E(G)} \frac{d_u + d_v}{2}, \\ \mathrm{MSK}_1(G) &= \prod_{uv\in E(G)} \frac{d_u \times d_v}{2}, \\ \mathrm{MSK}_2(G) &= \prod_{uv\in E(G)} \left(\frac{d_u + d_v}{2}\right)^2. \end{aligned} \tag{6}$$

For detailed study about topological indices and their applications, we refer [10, 11] and references therein. It is a proven fact that topological indices help to predict many properties without going to the wet lab [12–17]. For example, the first and second Zagreb indices were found to happen for the calculation of the π-electron energy of dendrimers, the Randić index corresponds with boiling point, the atomic bond connectivity (ABC) index gives an exceptionally decent relationship to figuring the strain energy of dendrimers and augmented Zagreb index is a good tool to guess the heat of formation of dendrimers, etc. There are more than around about 148 topological indices, but none of them can completely describe all properties of a chemical compound. Therefore there is always room to define and study new topological indices. Redefined Zagreb indices are one step in this direction and are very close to Zagreb indices. Zagreb indices are very well studied by chemists and mathematicians due to their huge applications in chemistry [18–22].

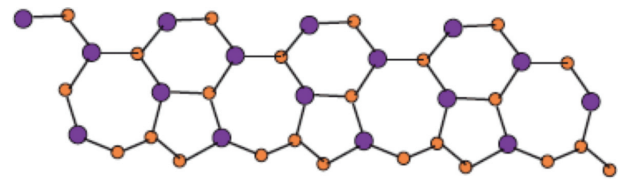

Figure 1: $\mathrm{Si_2C_3} - \mathrm{I}[4, 1]$.

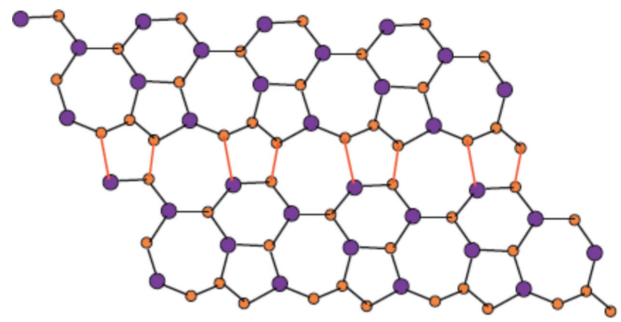

Figure 2: $\mathrm{Si_2C_3} - \mathrm{I}[4, 3]$.

In this paper, we aim to compute the above newly defined topological indices of Silicone Carbides $\mathrm{Si_2C_3} - \mathrm{I}[p, q]$, $\mathrm{Si_2C_3} - \mathrm{II}[p, q]$, $\mathrm{Si_2C_3} - \mathrm{III}[p, q]$, and $\mathrm{SiC_3} - \mathrm{III}[p, q]$.

2. Computational Results

In this section, we give our main results.

2.1. Multiplicative Shingali and Kanabour Indices for $Si_2C_3 - I[p, q]$. In order to describe the molecular graph of $\mathrm{Si_2C_3} - \mathrm{I}$, we have set this way. We define p as the number of connected units in a row (chain) and p as the number of connected rows, the number of p cells per connection. In Figures 1 and 2, we demonstrate how cells are connected in one row (chain) and how one row is connected to another row. For $\mathrm{Si_2C_3} - \mathrm{I}[p, q]$, $V(\mathrm{Si_2C_3} - \mathrm{I}[p, q]) = 10pq$ and $E(\mathrm{Si_2C_3} - \mathrm{I}[p, q]) = 15pq - 2p - 3q$.

The degree-based edge partition of $\mathrm{Si_2C_3} - \mathrm{I}$ is given in Table 1, which can be obtained easily by counting methods form Figures 1 and 2.

Theorem 1. *Let $Si_2C_3 - I[p, q]$ be Silicon Carbide. Then, we have the following:*

(1) $M\chi(Si_2C_3 - I[p, q]) = (1/20)\sqrt{10}(p + 2q)3((2p - 3) + 8q)(3p(5q - 3) - 13q + 7)$

(2) $MR'(Si_2C_3 - I[p, q]) = (1/108)(p + 2q)(3(2p - 3) + 8q)(3p(5q - 3) - 13q + 7)$

(3) $MAG_1(Si_2C_3 - I[p, q]) = (5/4)(p + 2q)(3(2p - 3) + 8q)(3p(5q - 3) - 13q + 7)$

(4) $MSK(Si_2C_3 - I[p, q]) = 45(p + 2q)(3(2p - 3) + 8q)(3p(5q - 3) - 13q + 7)$

(5) $MSK_1(Si_2C_3 - I[p, q]) = (81/2)(p + 2q)(3(2p - 3) + 8q)(3p(5q - 3) - 13q + 7)$

(6) $MSK_2(Si_2C_3 - I[p, q]) = 2025(p + 2q)(3(2p - 3) + 8q)(3p(5q - 3) - 13q + 7)$

Proof.

$$
\begin{aligned}
M\chi(\mathrm{Si_2C_3-I}[p,q]) &= \left(\frac{1}{\sqrt{1+2}}\right)(1)\times\left(\frac{1}{\sqrt{1+3}}\right)(1)\times\left(\frac{1}{\sqrt{2+2}}\right)(p+2q)\\
&\quad\times\left(\frac{1}{\sqrt{2+3}}\right)(p+2q)\times\left(\frac{1}{\sqrt{3+3}}\right)(3p(5q-3)-13q+7)\\
&= \frac{1}{20}\sqrt{10}(p+2q)(3(2p-3)+8q)(3p(5q-3)-13q+7),\\
\mathrm{MR}'(\mathrm{Si_2C_3-I}[p,q]) &= \prod_{uv\in E(\mathrm{Si_2C_3-I}[p,q])}\frac{1}{\max\{d_u,d_v\}}\\
&= \left(\frac{1}{2}\right)(1)\times\left(\frac{1}{3}\right)(1)\times\left(\frac{1}{1}\right)(p+2q)\\
&\quad\times\left(\frac{1}{3}\right)(3(2p-3)+8q)\times\left(\frac{1}{3}\right)(3p(5q-3)-13q+7)\\
&= \frac{1}{108}(p+2q)(3(2p-3)+8q)(3p(5q-3)-13q+7),\\
\mathrm{MAG_1}(\mathrm{Si_2C_3-I}[p,q]) &= \prod_{uv\in E(\mathrm{Si_2C_3-I}[p,q])}\frac{d_u+d_v}{2\sqrt{d_u\times d_v}}\\
&= \left(\frac{1+2}{2\sqrt{1\times 2}}\right)(1)\times\left(\frac{1+3}{2\sqrt{1\times 3}}\right)(1)\times\left(\frac{2+2}{2\sqrt{2\times 2}}\right)(p+2q)\\
&\quad\times\left(\frac{2+3}{2\sqrt{2\times 3}}\right)(3(2p-3)+8q)\times\left(\frac{3+3}{2\sqrt{3\times 3}}\right)(3p(5q-3)-13q+7)\\
&= \frac{5}{4}(p+2q)(3(2p-3)+8q)(3p(5q-3)-13q+7),\\
\mathrm{MSK}(\mathrm{Si_2C_3-I}[p,q]) &= \prod_{uv\in E(\mathrm{Si_2C_3-I}[p,q])}\frac{d_u+d_v}{2}\\
&= \left(\frac{1+2}{2}\right)(1)\times\left(\frac{1+3}{2}\right)(1)\times\left(\frac{2+2}{2}\right)(p+2q)\\
&\quad\times\left(\frac{2+3}{2}\right)(3(2p-3)+8q)\times\left(\frac{3+3}{2}\right)(3p(5q-3)-13q+7)\\
&= 45(p+2q)(3(2p-3)+8q)(3p(5q-3)-13q+7),\\
\mathrm{MSK_1}(\mathrm{Si_2C_3-I}[p,q]) &= \prod_{uv\in E(\mathrm{Si_2C_3-I}[p,q])}\frac{d_u\times d_v}{2}\\
&= \left(\frac{1\times 2}{2}\right)(1)\times\left(\frac{1\times 3}{2}\right)(1)\times\left(\frac{2\times 2}{2}\right)(p+2q)\\
&\quad\times\left(\frac{2\times 3}{2}\right)(3(2p-3)+8q)\times\left(\frac{3\times 3}{2}\right)(3p(5q-3)-13q+7)\\
&= \frac{81}{2}(p+2q)(3(2p-3)+8q)(3p(5q-3)-13q+7),\\
\mathrm{MSK_2}(\mathrm{Si_2C_3-I}[p,q]) &= \prod_{uv\in E(\mathrm{Si_2C_3-I}[p,q])}\left(\frac{d_u+d_v}{2}\right)^2\\
&= \left(\frac{1+2}{2}\right)^2(1)\times\left(\frac{1+3}{2}\right)^2(1)\times\left(\frac{2+2}{2}\right)^2(p+2q)\\
&\quad\times\left(\frac{2+3}{2}\right)^2(3(2p-3)+8q)\times\left(\frac{3+3}{2}\right)^2(3p(5q-3)-13q+7)\\
&= 2025(p+2q)(3(2p-3)+8q)(3p(5q-3)-13q+7).
\end{aligned}
\tag{7}
$$

□

Table 1: Partition of $E(\mathrm{Si_2C_3}-\mathrm{I}[p,q])$.

(d_u, d_v)	Frequency
(1, 2)	1
(1, 3)	1
(2, 2)	$p+2q$
(2, 3)	$6p-1+8\ (q-1)$
(3, 3)	$3p\ (5q-3)-13q+7$

2.2. Multiplicative Shingali and Kanabour Indices for $Si_2C_3-II[p,q]$. In order to describe the molecular graph of $\mathrm{Si_2C_3}-\mathrm{II}[p,q]$, we denote p as the number of unit cells connected in a row (chain) and q denotes the number of connected rows, the number of rows per connection. In Figures 3 and 4, we demonstrate how cells are connected in a row (chain) and how a row is connected to another row. For $\mathrm{Si_2C_3}-\mathrm{II}[p,q]$, $V(\mathrm{Si_2C_3}-\mathrm{II}[p,q]) = 8pq$ and $E(\mathrm{Si_2C_3}-\mathrm{II}[p,q]) = 15pq-3p-3q$.

The degree-based edge partition of $\mathrm{Si_2C_3}-\mathrm{II}$, is given in Table 2.

Theorem 2. *Let $Si_2C_3-II[p,q]$ be Silicon Carbides. Then, we have the following:*

(1) $M\chi(Si_2C_3-II[p,q]) = (1/15)\sqrt{10}(p+q)(4p+4q-7)(15pq-13(p+q)+11)$

(2) $MR'(Si_2C_3-II[p,q]) = (2/27)\sqrt{10}(p+q)(4p+4q-7)(15pq-13(p+q)+11)$

(3) $MAG_1(Si_2C_3-II[p,q]) = 10(p+q)(4p+4q-7)(15pq-13(p+q)+11)$

(4) $MSK(Si_2C_3-II[p,q]) = 360(p+q)(4p+4q-7)(15pq-13(p+q)+11)$

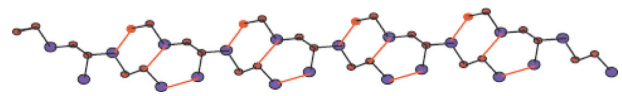

Figure 3: $\mathrm{Si_2C_3}-\mathrm{II}[5,1]$.

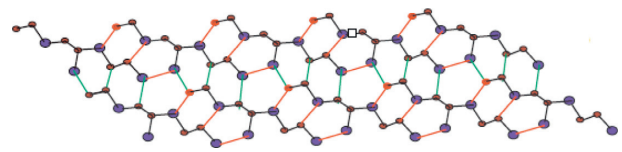

Figure 4: $\mathrm{Si_2C_3}-\mathrm{II}[5,2]$.

Table 2: Partition of $E(\mathrm{Si_2C_3}-\mathrm{II}[p,q])$.

(d_u, d_v)	Frequency
(1, 2)	2
(1, 3)	1
(2, 2)	$2\ (p+q)$
(2, 3)	$2\ (4p+4q-7)$
(3, 3)	$15pq-13\ (p+q)+11$

(5) $MSK_1(Si_2C_3-II[p,q]) = 324(p+q)(4p+4q-7)(15pq-13(p+q)+11)$

(6) $MSK_2(Si_2C_3-II[p,q]) = 7200(p+q)(4p+4q-7)(15pq-13(p+q)+11)$

Proof

$$M\chi(\mathrm{Si_2C_3}-\mathrm{II}[p,q]) = \prod_{uv\in E(\mathrm{Si_2C_3}-\mathrm{II}[p,q])} \frac{1}{\sqrt{d_u+d_v}}$$

$$= \left(\frac{1}{\sqrt{1+2}}\right)(2)\times\left(\frac{1}{\sqrt{1+3}}\right)(1)\times\left(\frac{1}{\sqrt{2+2}}\right)(2(p+q))$$

$$\times\left(\frac{1}{\sqrt{2+3}}\right)(2(4p+4q-7))\times\left(\frac{1}{\sqrt{3+3}}\right)(15pq-13(p+q)+11)$$

$$= \frac{1}{15}\sqrt{10}(p+q)(4p+4q-7)(15pq-13(p+q)+11),$$

$$\mathrm{MR}'(\mathrm{Si_2C_3}-\mathrm{II}[p,q]) = \prod_{uv\in E(\mathrm{Si_2C_3}-\mathrm{II}[p,q])} \frac{1}{\max\{d_u,d_v\}}$$

$$= \left(\frac{1}{2}\right)(2)\times\left(\frac{1}{3}\right)(1)\times\left(\frac{1}{1}\right)(2(p+q))$$

$$\times\left(\frac{1}{3}\right)(2(4p+4q-7))\times\left(\frac{1}{3}\right)(15pq-13(p+q)+11)$$

$$= \frac{2}{27}\sqrt{10}(p+q)(4p+4q-7)(15pq-13(p+q)+11),$$

$$\begin{aligned}
\mathrm{MAG}_1(\mathrm{Si}_2\mathrm{C}_3-\mathrm{II}[p,q]) &= \sum_{uv\in E(\mathrm{Si}_2\mathrm{C}_3-\mathrm{II}[p,q])} \frac{d_u+d_v}{2\sqrt{d_u\times d_v}} \\
&= \left(\frac{1+2}{2\sqrt{1\times 2}}\right)(2)\times\left(\frac{1+3}{2\sqrt{1\times 3}}\right)(1)\times\left(\frac{2+2}{2\sqrt{2\times 2}}\right)(2(p+q)) \\
&\quad\times\left(\frac{2+3}{2\sqrt{2\times 3}}\right)(2(4p+4q-7))\times\left(\frac{3+3}{2\sqrt{3\times 3}}\right)(15pq-13(p+q)+11) \\
&= 10(p+q)(4p+4q-7)(15pq-13(p+q)+11), \\
\mathrm{MSK}(\mathrm{Si}_2\mathrm{C}_3-\mathrm{II}[p,q]) &= \sum_{uv\in E(\mathrm{Si}_2\mathrm{C}_3-\mathrm{II}[p,q])} \frac{d_u+d_v}{2} \\
&= \left(\frac{1+2}{2}\right)(2)\times\left(\frac{1+3}{2}\right)(1)\times\left(\frac{2+2}{2}\right)(2(p+q)) \\
&\quad\times\left(\frac{2+3}{2}\right)(2(4p+4q-7))\times\left(\frac{3+3}{2}\right)(15pq-13(p+q)+11) \\
&= 360(p+q)(4p+4q-7)(15pq-13(p+q)+11), \\
\mathrm{MSK}_1(\mathrm{Si}_2\mathrm{C}_3-\mathrm{II}[p,q]) &= \sum_{uv\in E(\mathrm{Si}_2\mathrm{C}_3-\mathrm{II}[p,q])} \frac{d_u\times d_v}{2} \\
&= \left(\frac{1\times 2}{2}\right)(2)\times\left(\frac{1\times 3}{2}\right)(1)\times\left(\frac{2\times 2}{2}\right)(2(p+q)) \\
&\quad\times\left(\frac{2.\times 3}{2}\right)(2(4p+4q-7))\times\left(\frac{3\times 3}{2}\right)(15pq-13(p+q)+11) \\
&= 324(p+q)(4p+4q-7)(15pq-13(p+q)+11), \\
\mathrm{MSK}_2(\mathrm{Si}_2\mathrm{C}_3-\mathrm{II}[p,q]) &= \sum_{uv\in E(\mathrm{Si}_2\mathrm{C}_3-\mathrm{II}[p,q])} \left(\frac{d_u+d_v}{2}\right)^2 \\
&= \left(\frac{1+2}{2}\right)^2(2)\times\left(\frac{1+3}{2}\right)^2(1)\times\left(\frac{2+2}{2}\right)^2(2(p+q)) \\
&\quad\times\left(\frac{2+3}{2}\right)^2(2(4p+4q-7))\times\left(\frac{3+3}{2}\right)^2(15pq-13(p+q)+11) \\
&= 7200(p+q)(4p+4q-7)(15pq-13(p+q)+11).
\end{aligned} \tag{8}$$

□

2.3. Multiplicative Shingali and Kanabour Indices for $Si_2C_3-III[p,q]$. The 2D molecular graph of Silicon Carbide $\mathrm{Si}_2\mathrm{C}_3-\mathrm{III}$ is given in Figures 5 and 6. We can define the molecular graph in this way, where p represents the unit cell in a row and q represented the number of connected rows. For $\mathrm{Si}_2\mathrm{C}_3-\mathrm{III}[p,q]$, $V(\mathrm{Si}_2\mathrm{C}_3-\mathrm{III}[p,q])=10pq$ and $E(\mathrm{Si}_2\mathrm{C}_3-\mathrm{III}[p,q])=15pq-2p-3q$.

The degree-based edge partition of $\mathrm{Si}_2\mathrm{C}_3-\mathrm{III}$ is given in Table 3.

Theorem 3. *Let $Si_2C_3-III[p,q]$ be Silicon Carbides. Then, we have the following:*

(1) $M\chi(Si_2C_3-III[p,q]) = (2/15)\sqrt{30}(p+1)(2(p+q)-3)(5p(3q-2)-13q+8)$

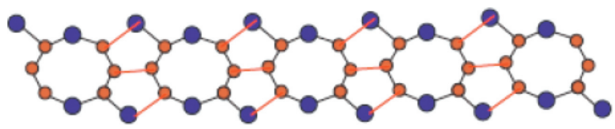

Figure 5: $Si_2C_3 - III[5,1]$.

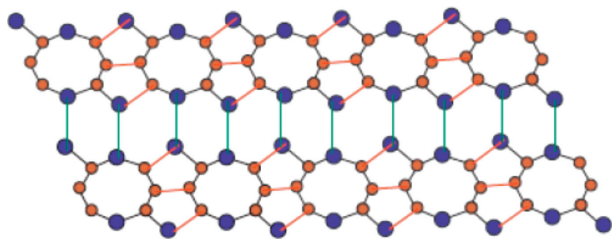

Figure 6: $Si_2C_3 - III[5,2]$.

Table 3: Partition of $E(Si_2C_3 - III[p,q])$.

(d_u, d_v)	Frequency
(1, 3)	2
(2, 2)	$2p+2$
(2, 3)	$4\ (2p+2q-3)$
(3, 3)	$5p\ (3q-2)-13q+8$

(2) $MR'(Si_2C_3 - III[p,q]) = (8/27)(p+1)(2(p+q)-3)(5p(3q-2)-13q+8)$

(3) $MAG_1(Si_2C_3 - III[p,q]) = (40/3)\sqrt{2}(p+1)(2(p+q)-3)(5p(3q-2)-13q+8)$

(4) $MSK(Si_2C_3 - III[p,q]) = 480(p+1)(2(p+q)-3)(5p(3q-2)-13q+8)$

(5) $MSK_1(Si_2C_3 - III[p,q]) = 648(p+1)(2(p+q)-3)(5p(3q-2)-13q+8)$

(6) $MSK_2(Si_2C_3 - III[p,q]) = 14400(p+1)(2(p+q)-3)(5p(3q-2)-13q+8)$

Proof.

$$
\begin{aligned}
M\chi(\mathrm{Si_2C_3} - \mathrm{III}[p,q]) &= \prod_{uv\in E(\mathrm{Si_2C_3}-\mathrm{III}[p,q])} \frac{1}{\sqrt{d_u + d_v}} \\
&= \left(\frac{1}{\sqrt{1+3}}\right)(2) \times \left(\frac{1}{\sqrt{2+2}}\right)(2p+2) \\
&\quad \times \left(\frac{1}{\sqrt{2+3}}\right)(4(2p+2q-3)) \times \left(\frac{1}{\sqrt{3+3}}\right)(5p(3q-2)-13q+8) \\
&= \frac{2}{15}\sqrt{30}(p+1)(2(p+q)-3)(5p(3q-2)-13q+8),
\end{aligned}
$$

$$
\begin{aligned}
\mathrm{MR}'(\mathrm{Si_2C_3} - \mathrm{III}[p,q]) &= \prod_{uv\in E(\mathrm{Si_2C_3}-\mathrm{III}[p,q])} \frac{1}{\max\{d_u, d_v\}} \\
&= \left(\frac{1}{3}\right)(2) \times \left(\frac{1}{1}\right)(2p+2) \\
&\quad \times \left(\frac{1}{3}\right)(4(2p+2q-3)) \times \left(\frac{1}{3}\right)(5p(3q-2)-13q+8) \\
&= \frac{8}{27}(p+1)(2(p+q)-3)(5p(3q-2)-13q+8),
\end{aligned}
$$

$$\begin{aligned}
\mathrm{MAG}_1(\mathrm{Si}_2\mathrm{C}_3-\mathrm{III}[p,q]) &= \prod_{uv\in E(\mathrm{Si}_2\mathrm{C}_3-\mathrm{III}[p,q])} \frac{d_u+d_v}{2\sqrt{d_u\times d_v}} \\
&= \left(\frac{1+3}{2\sqrt{1\times 3}}\right)(2)\times\left(\frac{2+2}{2\sqrt{2\times 2}}\right)(2p+2) \\
&\quad\times\left(\frac{2+3}{2\sqrt{2\times 3}}\right)(4(2p+2q-3))\times\left(\frac{3+3}{2\sqrt{3\times 3}}\right)(5p(3q-2)-13q+8) \\
&= \frac{40}{3}\sqrt{2}(p+1)(2(p+q)-3)(5p(3q-2)-13q+8), \\
\mathrm{MSK}(\mathrm{Si}_2\mathrm{C}_3-\mathrm{III}[p,q]) &= \prod_{uv\in E(\mathrm{Si}_2\mathrm{C}_3-\mathrm{III}[p,q])} \frac{d_u+d_v}{2} \\
&= \left(\frac{1+3}{2}\right)(2)\times\left(\frac{2+2}{2}\right)(2p+2)\times\left(\frac{2+3}{2}\right)(4(2p+2q-3))\times\left(\frac{3+3}{2}\right)(5p(3q-2)-13q+8) \\
&= 480(p+1)(2(p+q)-3)(5p(3q-2)-13q+8), \\
\mathrm{MSK}_1(\mathrm{Si}_2\mathrm{C}_3-\mathrm{III}[p,q]) &= \prod_{uv\in E(\mathrm{Si}_2\mathrm{C}_3-\mathrm{III}[p,q])} \frac{d_u\times d_v}{2} \\
&= \left(\frac{1.3}{2}\right)(2)\times\left(\frac{2.2}{2}\right)(2p+2) \\
&\quad\times\left(\frac{2.3}{2}\right)(4(2p+2q-3))\times\left(\frac{3.3}{2}\right)(5p(3q-2)-13q+8) \\
&= 648(p+1)(2(p+q)-3)(5p(3q-2)-13q+8), \\
\mathrm{MSK}_2(\mathrm{Si}_2\mathrm{C}_3-\mathrm{III}[p,q]) &= \prod_{uv\in E(\mathrm{Si}_2\mathrm{C}_3-\mathrm{III}[p,q])} \left(\frac{d_u+d_v}{2}\right)^2 \\
&= \left(\frac{1+3}{2}\right)^2(2)\times\left(\frac{2+2}{2}\right)^2(2p+2) \\
&\quad\times\left(\frac{2+3}{2}\right)^2(4(2p+2q-3))\times\left(\frac{3+3}{2}\right)^2(5p(3q-2)-13q+8) \\
&= 14400(p+1)(2(p+q)-3)(5p(3q-2)-13q+8).
\end{aligned} \tag{9}$$

□

2.4. Multiplicative Shingali and Kanabour Indices for $SiC_3-III[p,q]$. Figures 7 and 8 represented the algebraic graphs of Silicon Carbide $\mathrm{SiC}_3-\mathrm{III}[p,q]$ for different values of p and q, and with the help of these structures, we gave a demonstration of how the cells connect in a row (chain) and how one row connects to another row. For $\mathrm{SiC}_3-\mathrm{III}[p,q]$, $V(\mathrm{SiC}_3-\mathrm{III}[p,q])=8pq$ and $E(\mathrm{SiC}_3-\mathrm{III}[p,q])=12pq-3p-2q$.

The degree-based edge partition of $\mathrm{SiC}_3-\mathrm{III}$ is given in Table 4.

Theorem 4. *Let $SiC_3-III[p,q]$ be Silicon Carbides. Then, we have the following:*

(1) $M\chi(SiC_3-III[p,q]) = (2/15)\sqrt{10}(3p+2q-3)(3p+2q-4)(3pq-3p-2q+2)$

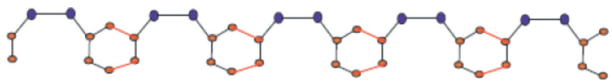

Figure 7: $SiC_3 - III[5,1]$.

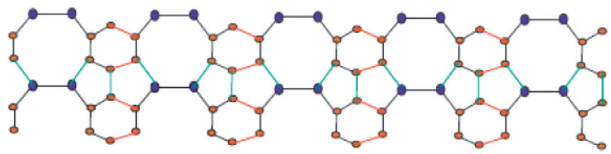

Figure 8: $SiC_3 - III[5,1]$.

Table 4: Partition of $E(SiC_3 - III[p,q])$.

(d_u, d_v)	Frequency
(1, 2)	2
(1, 3)	1
(2, 2)	$3p+2q-3$
(2, 3)	$2\ (3p+2q-4)$
(3, 3)	$4\ (3pq-3p-2q+2)$

(2) $MR'(SiC_3 - III[p,q]) = (4/27)(3p+2q-3)(3p+2q-4)(3pq-3p-2q+2)$

(3) $MAG_1(SiC_3 - III[p,q]) = 20(3p+2q-3)(3p+2q-4)(3pq-3p-2q+2)$

(4) $MSK(SiC_3 - III[p,q]) = 720(3p+2q-3)(3p+2q-4)(3pq-3p-2q+2)$

(5) $MSK_1(SiC_3 - III[p,q]) = 14400(3p+2q-3)(3p+2q-4)(3pq-3p-2q+2)$

(6) $MSK_2(SiC_3 - III[p,q]) = 32400(3p+2q-3)(3p+2q-4)(3pq-3p-2q+2)$

Proof.

$$M\chi(\mathrm{SiC}_3 - \mathrm{III}[p,q]) = \prod_{uv\in E(\mathrm{SiC}_3-\mathrm{III}[p,q])} \frac{1}{\sqrt{d_u+d_v}}$$

$$= \left(\frac{1}{\sqrt{1+2}}\right)(2)\times\left(\frac{1}{\sqrt{1+3}}\right)(1)\times\left(\frac{1}{\sqrt{2+2}}(3p+2q-3)\right)$$

$$\times\left(\frac{1}{\sqrt{2+3}}\right)(2(3p+2q-4))\times\left(\frac{1}{\sqrt{3+3}}\right)(4(3pq-3p-2q+2))$$

$$= \frac{2}{15}\sqrt{10}(3p+2q-3)(3p+2q-4)(3pq-3p-2q+2),$$

$$\mathrm{MR}'(\mathrm{SiC}_3 - \mathrm{III}[p,q]) = \prod_{uv\in E(\mathrm{SiC}_3-\mathrm{III}[p,q])} \frac{1}{\max\{d_u,d_v\}}$$

$$= \left(\frac{1}{2}\right)(2)\times\left(\frac{1}{3}\right)(1)\times\left(\frac{1}{1}\right)(3p+2q-3)$$

$$\times\left(\frac{1}{3}\right)(2(3p+2q-4))\times\left(\frac{1}{3}\right)(4(3pq-3p-2q+2))$$

$$= \frac{4}{27}(3p+2q-3)(3p+2q-4)(3pq-3p-2q+2),$$

$$\mathrm{MAG}_1(\mathrm{SiC}_3 - \mathrm{III}[p,q]) = \prod_{uv\in E(\mathrm{SiC}_3-\mathrm{III}[p,q])} \frac{d_u+d_v}{2\sqrt{d_u\times d_v}}$$

$$= \left(\frac{1+2}{2\sqrt{1\times 2}}\right)(2)\times\left(\frac{1+3}{2\sqrt{1\times 3}}\right)(1)\times\left(\frac{2+2}{2\sqrt{2\times 2}}\right)(3p+2q-3)$$

$$\times\left(\frac{2+3}{2\sqrt{2.\times 3}}\right)(2(3p+2q-4))\times\left(\frac{3+3}{2\sqrt{3\times 3}}\right)(4(3pq-3p-2q+2))$$

$$=20(3p+2q-3)(3p+2q-4)(3pq-3p-2q+2),$$

$$\begin{aligned}
\mathrm{MSK}(\mathrm{SiC}_3-\mathrm{III}[p,q]) &= \prod_{uv\in E(\mathrm{SiC}_3-\mathrm{III}[p,q])}\frac{d_u+d_v}{2}\\
&=\left(\frac{1+2}{2}\right)(2)\times\left(\frac{1+3}{2}\right)(1)\times\left(\frac{2+2}{2}\right)(3p+2q-3)\\
&\quad\times\left(\frac{2+3}{2}\right)(2(3p+2q-4))\times\left(\frac{3+3}{2}\right)(4(3pq-3p-2q+2))\\
&=720(3p+2q-3)(3p+2q-4)(3pq-3p-2q+2),\\
\mathrm{MSK}_1(\mathrm{SiC}_3-\mathrm{III}[p,q]) &= \prod_{uv\in E(\mathrm{SiC}_3-\mathrm{III}[p,q])}\frac{d_u\times d_v}{2}\\
&=\left(\frac{1\times 2}{2}\right))(2)\times\left(\frac{1\times 3}{2}\right)(1)\times\left(\frac{2\times 2}{2}\right)(3p+2q-3)\\
&\quad\times\left(\frac{2\times 3}{2}\right)(2(3p+2q-4))\times\left(\frac{3\times 3}{2}\right)(4(3pq-3p-2q+2))\\
&=14400(3p+2q-3)(3p+2q-4)(3pq-3p-2q+2),\\
\mathrm{MSK}_2(\mathrm{SiC}_3-\mathrm{III}[p,q]) &= \sum_{uv\in E(\mathrm{SiC}_3-\mathrm{III}[p,q])}\left(\frac{d_u+d_v}{2}\right)^2\\
&=\left(\frac{1+2}{2}\right)^2(2)\times\left(\frac{1+3}{2}\right)^2(1)\times\left(\frac{2+2}{2}\right)^2(3p+2q-3)\\
&\quad\times\left(\frac{2+3}{2}\right)^2(2(3p+2q-4))\times\left(\frac{3+3}{2}\right)^2(4(3pq-3p-2q+2)\\
&=32400(3p+2q-3)(3p+2q-4)(3pq-3p-2q+2).
\end{aligned}\tag{10}$$

□

3. Conclusion

In this paper, we have introduced some new multiplicative degree-based indices. We also computed the newly introduced indices for Silicone Carbides $\mathrm{Si}_2\mathrm{C}_3-\mathrm{I}[p,q]$, $\mathrm{Si}_2\mathrm{C}_3-\mathrm{II}[p,q]$, $\mathrm{Si}_2\mathrm{C}_3-\mathrm{III}[p,q]$, and $\mathrm{SiC}_3-\mathrm{III}[p,q]$. Our results are applicable in chemistry, physics, and other applied sciences.

4. Future Directions

To compute distance-based indices and polynomials of understudy Silicone Carbides is an interesting problem for the researchers.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

All authors have an equal contribution.

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References

[1] N. Ali, M. A. Umar, M. A. Umar, A. Tabassum, and A. Raheem, "Super (a, d)-C3-antimagicness of a corona graph," *Open Journal of Mathematical Sciences*, vol. 2, no. 1, pp. 371–378, 2018.

[2] M. K. Jamil, M. R. Farahani, M. Imran, and M. Ali Malik, "Computing eccentric version of second zagreb index of polycyclic aromatic hydrocarbons (PAHk)," *Applied Mathematics and Nonlinear Sciences*, vol. 1, no. 1, pp. 247–252, 2016.

[3] D. Amić and D. Bes, lo, B. Lucic, S. Nikolic, and N. Trinajstic, The vertex-connectivity index revisited," *Journal of Chemical Information and Computer Sciences*, vol. 38, no. 5, pp. 819–822, 1998.

[4] B. Bollobás and P. Erd, os, Graphs of extremal weights," *Ars Combinatoria*, vol. 50, pp. 225–233, 1998.

[5] F. M. Brückler, T. Došlić, A. Graovac, and I. Gutman, "On a class of distance-based molecular structure descriptors," *Chemical Physics Letters*, vol. 503, no. 4–6, pp. 336–338, 2011.

[6] H. Wiener, "Structural determination of paraffin boiling points," *Journal of the American Chemical Society*, vol. 69, no. 1, pp. 17–20, 1947.

[7] H. Hosoya, "On some counting polynomials in chemistry," *Discrete Applied Mathematics*, vol. 19, pp. 239–257, 1998.

[8] L. Kier, *Molecular Connectivity in Chemistry and Drug Research*, Vol. 10, Elsevier, Amsterdam, Netherlands, 1999.

[9] V. S. Shigehalli and R. Kanabur, "Computation of new degree-based topological indices of graphene," *Journal of Nanomaterials*, vol. 2016, Article ID 4341919, 6 pages, 2016.

[10] G. Caporossi, I. Gutman, P. Hansen, and L. Pavlović, "Graphs with maximum connectivity index," *Computational Biology and Chemistry*, vol. 27, no. 1, pp. 85–90, 2003.

[11] H. Deng, J. Yang, and F. Xia, "A general modeling of some vertex-degree based topological indices in benzenoid systems and phenylenes," *Computers & Mathematics with Applications*, vol. 61, no. 10, pp. 3017–3023, 2011.

[12] B. Basavanagoud, W. Gao, S. Patil, V. R. Desai, K. G. Mirajkar, and B. Pooja, "Computing first zagreb index and F-index of new C-products of graphs," *Applied Mathematics and Nonlinear Sciences*, vol. 2, no. 1, pp. 285–298, 2017.

[13] V. Lokesha, T. Deepika, P. S. Ranjini, and I. N. Cangul, "Operations of nanostructures via sdd, ABC4 and GA5 indices," *Applied Mathematics and Nonlinear Sciences*, vol. 2, no. 1, pp. 173–180, 2017.

[14] S. M. Hosamani, B. B. Kulkarni, R. G. Boli, and V. M. Gadag, "QSPR analysis of certain graph theocratical matrices and their corresponding energy," *Applied Mathematics and Nonlinear Sciences*, vol. 2, no. 1, pp. 131–150, 2017.

[15] M. S. Sardar, S. Zafar, and Z. Zahid, "Computing topological indices of the line graphs of banana tree graph and firecracker graph," *Applied Mathematics and Nonlinear Sciences*, vol. 2, no. 1, pp. 83–92, 2017.

[16] B. Basavanagoud, V. R. Desai, and S. Patil, "(β, α)–connectivity index of graphs," *Applied Mathematics and Nonlinear Sciences*, vol. 2, no. 1, pp. 21–30, 2017.

[17] H. S. Ramane and R. B. Jummannaver, "Note on forgotten topological index of chemical structure in drugs," *Applied Mathematics and Nonlinear Sciences*, vol. 1, no. 2, pp. 369–374, 2016.

[18] J.-B. Liu, C. Wang, S. Wang, and B. Wei, "Zagreb indices and multiplicative zagreb indices of eulerian graphs," *Bulletin of the Malaysian Mathematical Sciences Society*, vol. 42, no. 1, pp. 67–78, 2019.

[19] J.-B. Liu, X.-F. Pan, F.-T. Hu, and F.-F. Hu, "Asymptotic laplacian-energy-like invariant of lattices," *Applied Mathematics and Computation*, vol. 253, pp. 205–214, 2015.

[20] J.-B. Liu and X.-F. Pan, "Minimizing kirchhoff index among graphs with a given vertex bipartiteness," *Applied Mathematics and Computation*, vol. 291, pp. 84–88, 2016.

[21] H. Liu, Y. Pan, and J. Cao, "Composite learning adaptive dynamic surface control of fractional-order nonlinear systems," *IEEE Transactions on Cybernetics*, vol. 50, no. 6, pp. 2557–2567, 2020.

[22] H. Liu, H. Wang, J. Cao, A. Alsaedi, and T. Hayat, "Composite learning adaptive sliding mode control of fractional-order nonlinear systems with actuator faults," *Journal of the Franklin Institute*, vol. 356, no. 16, pp. 9580–9599, 2019.