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MULTIPLICATIVE PRODUCT CONNECTIVITY AND MULTIPLICATIVE SUM CONNECTIVITY INDICES OF DENDRIMER NANOSTARS

V.R. Kulli *
*Department of Mathematics, Gulbarga University, Gulbarga, 585106, India

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ABSTRACT

In Chemical Graph Theory, the connectivity indices are applied to measure the chemical characteristics of compounds. In this paper, we compute the multiplicative product connectivity index and the multiplicative sum connectivity index of three infinite families $NS_1[n]$, $NS_2[n]$, $NS_3[n]$ dendrimer nanostars.

Mathematics Subject Classification : 05*C*05, 05*C*012, 05*C*090,

KEYWORDS: multiplicative product connectivity index, multiplicative sum connectivity index, dendrimer nanostar.

I. INTRODUCTION

Let G be a finite, simple connected graph with vertex set $V(G)$ and edge set $E(G)$. The degree $d_G(v)$ of a vertex v is the number of vertices adjacent to v. We refer to [1] for undefined term and notation.

A molecular graph or a chemical graph is a finite, simple graph such that its vertices correspond to the atoms and the edges to the bonds. Chemical Graph Theory is a branch of Mathematical chemistry which has an important effect on the development of the chemical sciences. A single number that can be used to characterize some property of the graph of a molecular is called topological index of that graph. There are several topological indices that have some applications in chemistry in *QSPR*/*QSAR* study [2].

Motivated by the definition of the product connectivity index and its wide applications, Kulli [3] introduced the multiplicative product connectivity index and multiplicative sum connectivity index of a molecular graph as follows:

The multiplicative product connectivity index of a graph G is defined as

$$\chi II(G) = \prod_{uv\in E(G)} \frac{1}{\sqrt{d_G(u)d_G(v)}}$$

The multiplicative sum connectivity index of a graph G is defined as

$$XII(G) = \prod_{uv\in E(G)} \frac{1}{\sqrt{d_G(u)+d_G(v)}}.$$

Recently many multiplicative indices were studied, for example, in [4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18]. Also some connectivity indices were studied, for example, in [19, 20, 21, 22, 23, 24, 25].

In this paper, we compute the multiplicative product connectivity index and multiplicative sum connectivity index for three infinite classes $NS_1[n]$, $NS_2[n]$ and $NS_3[n]$ dendrimer nanostars. For more information about these dendrimer nanostars see [26, 27].

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II. RESULTS FOR $NS_1[N]$ DENDRIMER NANOSTARS

We consider the first class of dendrimer nanostars. This family of dendrimer nanostars is symbolized by $NS_1[n]$, where n is steps of growth in this type of dendrimer nanostars. The graph of $NS_1[3]$ dendrimer nanostar is presented in Figure 1.

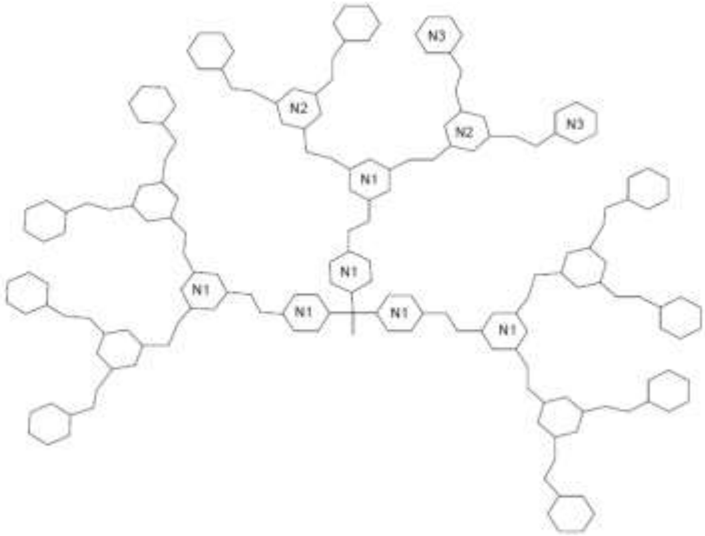

Figure 1. The graph of $NS_1[3]$

In the following theorem, we compute the multiplicative product connectivity index of $NS_1[n]$ dendrimer nanostars.

Theorem 1. The multiplicative product connectivity index of $NS_1[n]$ dendrimer nanostar is

$$\chi II\left(NS_1[n]\right)=\left(\frac{1}{2\sqrt{3}}\right)^{3}\times\left(\frac{1}{2}\right)^{9\times2^n+4}\times\left(\frac{1}{6}\right)^{9\times2^n-6}.$$

Proof: Let G be the graph of $NS_1[n]$ dendrimer nanostar. By calculation, we obtain that G has $27\times2^n-5$ edges. We can see easily that the vertices of $NS_1[n]$ are of degree 1, 2, 3 or 4, see Figure 1. Also by calculation, we obtain that G has four types of edges based on the degree of end vertices of each edge as given in Table 1.

Table 1. Edge partition of $NS_1[n]$

$d_G(u), d_G(v)\backslash uv\in E(G)$	(1, 4)	(2, 2)	(2, 3)	(3, 4)
Number of edges	1	$9\times2^n+3$	$18\times2^n-12$	3

We have $\chi II(G)=\prod_{uv\in E(G)}\frac{1}{\sqrt{d_G(u)d_G(v)}}$.

By using Table 1, we have

$$\chi II\left(NS_1[n]\right)=\left(\frac{1}{\sqrt{1\times4}}\right)^{1}\times\left(\frac{1}{\sqrt{2\times2}}\right)^{9\times2^n+3}\times\left(\frac{1}{\sqrt{2\times3}}\right)^{18\times2^n-12}\times\left(\frac{1}{\sqrt{3\times4}}\right)^{3}.$$

$$=\left(\frac{1}{2\sqrt{3}}\right)^{3}\times\left(\frac{1}{2}\right)^{9\times2^n+4}\times\left(\frac{1}{6}\right)^{9\times2^n-6}.$$

In the next theorem, we compute the multiplicative sum connectivity index of $NS_1[n]$ dendrimer nanostars.

Theorem 2. The multiplicative sum connectivity index of $NS_1[n]$ dendrimer nanostar is

$$XII\left(NS_1[n]\right)=\left(\frac{1}{\sqrt{7}}\right)^{3}\times\left(\frac{1}{2}\right)^{9\times2^n+3}\times\left(\frac{1}{\sqrt{5}}\right)^{18\times2^n-11}.$$

Proof: We have $XII(G)=\prod_{uv\in E(G)}\frac{1}{\sqrt{d_G(u)+d_G(v)}}$.

By using Table 1, we have

$$XII(NS_1[n])=\left(\frac{1}{\sqrt{1+4}}\right)^{1}\times\left(\frac{1}{\sqrt{2+2}}\right)^{9\times 2^n+3}\times\left(\frac{1}{\sqrt{2+3}}\right)^{18\times 2^n-12}\times\left(\frac{1}{\sqrt{3+4}}\right)^{3}.$$

$$=\left(\frac{1}{\sqrt{7}}\right)^{3}\times\left(\frac{1}{2}\right)^{9\times 2^n+3}\times\left(\frac{1}{\sqrt{5}}\right)^{18\times 2^n-11}.$$

III. RESULTS FOR $NS_2[N]$ DENDRIMER NANOSTARS

We consider the second class of dendrimer nanostars. This family of dendrimer nanostars is symbolized by $NS_2[n]$, where n is steps of growth in this type of dendrimer nanostars. The graph of $NS_2[2]$ dendrimer nanostar is shown in Figure 2.

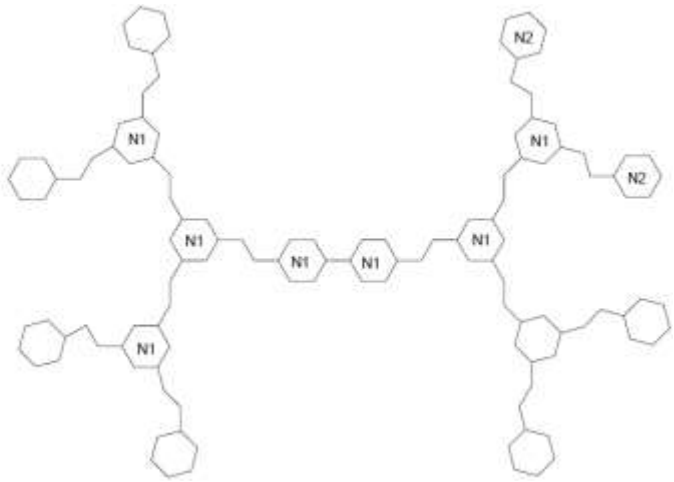

Figure 2 The graph of $NS_2[2]$

In the following theorem, we compute the multiplicative product connectivity index of $NS_2[n]$ dendrimer nanostar.

Theorem 3. The multiplicative product connectivity index of $NS_2[n]$ dendrimer nanostar is

$$\chi II(NS_2[n])=\left(\frac{1}{3}\right)\times\left(\frac{1}{2}\right)^{12\times 2^n+2}\times\left(\frac{1}{6}\right)^{12\times 2^n-4}.$$

Proof: Let H be the graph of $NS_2[n]$ dentrimer nanostar. By calculation, we obtain that H has $36\times 2^n-5$ edges. One can see easily that the vertices of $NS_2[n]$ are of degree 2 or 3, see Figure 2. Also by calculation, we obtain that H has three types of edges based on the degree of end vertices of each edge as given in Table 2.

Table 2. Edge partition of $NS_2[n]$

$d_H(u), d_H(v)\backslash uv\in E(H)$	(2, 2)	(2, 3)	(3, 3)
Number of edges	$12\times 2^n+2$	$24\times 2^n-8$	1

We have $\chi II(H)=\prod_{uv\in E(H)}\frac{1}{\sqrt{d_H(u)d_H(v)}}$.

By using Table 1, we have

$$\chi II(NS_2[n])=\left(\frac{1}{\sqrt{2\times 2}}\right)^{12\times 2^n+2}\times\left(\frac{1}{\sqrt{2\times 3}}\right)^{24\times 2^n-8}\times\left(\frac{1}{\sqrt{3\times 3}}\right)^{1}.$$

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$$=\left(\frac{1}{3}\right)\times\left(\frac{1}{2}\right)^{12\times 2^n+2}\times\left(\frac{1}{6}\right)^{12\times 2^n-4}.$$

In the next theorem, we compute the multiplicative sum connectivity index of $NS_2[n]$ dendrimer nanostar.

Theorem 4. The multiplicative sum connectivity index of $NS_2[n]$ dendrimer nanostar is

$$XII\left(NS_2[n]\right)=\left(\frac{1}{\sqrt{6}}\right)\times\left(\frac{1}{2}\right)^{12\times 2^n+2}\times\left(\frac{1}{\sqrt{5}}\right)^{24\times 2^n-8}.$$

Proof: We have $XII(H)=\prod_{uv\in E(H)}\frac{1}{\sqrt{d_H(u)+d_H(v)}}$

By using Table 1, we have

$$XII\left(NS_2[n]\right)=\left(\frac{1}{\sqrt{2+2}}\right)^{12\times 2^n+2}\times\left(\frac{1}{\sqrt{2+3}}\right)^{24\times 2^n-8}\times\left(\frac{1}{\sqrt{3+3}}\right)^{1}.$$

$$=\left(\frac{1}{\sqrt{6}}\right)\times\left(\frac{1}{2}\right)^{12\times 2^n+2}\times\left(\frac{1}{\sqrt{5}}\right)^{24\times 2^n-8}.$$

IV. RESULTS FOR $NS_3[N]$ DENDRIMER NANOSTARS

We consider the third class of dendrimer nanostars. This family of dendrimer nanostars is symbolized by $NS_3[n]$, where n is steps of growth in this type of dendrimer nanostar. The graph of $NS_3[n]$ dendrimer nanostar is presented in Figure 3.

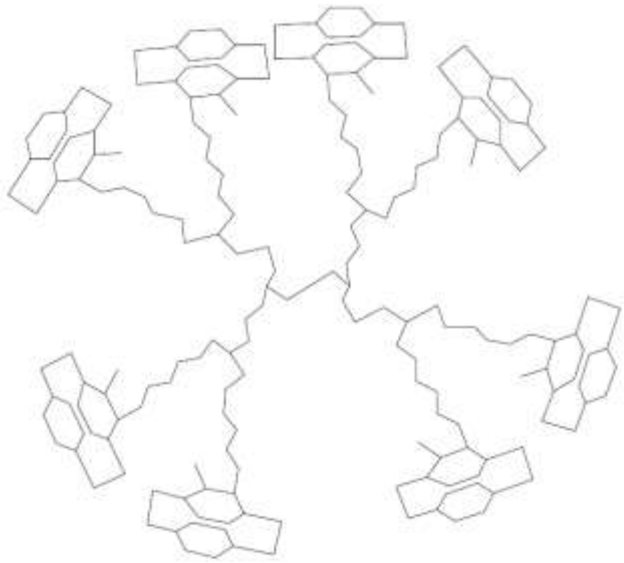

Figure 3. The graph of NS_3[n]

In the following theorem, we compute the multiplicative product connectivity index of $NS_3[n]$ dendrimer nanostars.

Theorem 5. The multiplicative product connectivity index of $NS_3[n]$ dendrimer nanostar is

$$\chi II\left(NS_3[n]\right)=\left(\frac{1}{3}\right)^{7\times 2^n}\times\left(\frac{1}{2}\right)^{22\times 2^n-7}\times\left(\frac{1}{6}\right)^{14\times 2^n-3}.$$

Proof: Let G be the graph of $NS_3[n]$ dendrimer nanostar. By calculation, we obtain that G has $58 \times 2^n - 13$ edges. We can see easily that the vertices of $NS_3[n]$ are of degree 1, 2 or 3, see Figure 3. Also by calculation, we obtain that G has four types of edges based on the degree of end vertices of each edge as given in Table 3.

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Table 3. Edge partition of $NS_3[n]$

$d_G(u), d_G(v)\backslash uv\in E(G)$	(1, 3)	(2, 2)	(2, 3)	(3, 3)
Number of edges	2^{n+1}	$22\times2^n-7$	$28\times2^n-6$	6×2^n

We have $$\chi II(G)=\prod_{uv\in E(G)}\frac{1}{\sqrt{d_G(u)d_G(v)}}.$$

By using Table 3, we have

$$\chi II(NS_3[n])=\left(\frac{1}{\sqrt{1\times3}}\right)^{2^{n+1}}\times\left(\frac{1}{\sqrt{2\times2}}\right)^{22\times2^n-7}\times\left(\frac{1}{\sqrt{2\times3}}\right)^{28\times2^n-6}\times\left(\frac{1}{\sqrt{3\times3}}\right)^{6\times2^n}.$$

$$=\left(\frac{1}{3}\right)^{7\times2^n}\times\left(\frac{1}{2}\right)^{22\times2^n-7}\times\left(\frac{1}{6}\right)^{14\times2^n-3}.$$

In the next theorem, we compute the multiplicative sum connectivity index of $NS_3[n]$ dendrimer nanostar.

Theorem 6. The multiplicative sum connectivity index of $NS_2[n]$ dendrimer nanostar is

$$XII(NS_3[n])=\left(\frac{1}{2}\right)^{2^{n+1}}\times\left(\frac{1}{2}\right)^{12\times2^n-7}\times\left(\frac{1}{5}\right)^{14\times2^n-3}\times\left(\frac{1}{6}\right)^{3\times2^n}.$$

Proof: We have $XII(G)=\prod_{uv\in E(G)}\frac{1}{\sqrt{d_G(u)+d_G(v)}}.$

By using Table 3, we have

$$XII(NS_3[n])=\left(\frac{1}{\sqrt{1+3}}\right)^{2^{n+1}}\times\left(\frac{1}{\sqrt{2+2}}\right)^{22\times2^n-7}\times\left(\frac{1}{\sqrt{2+3}}\right)^{28\times2^n-6}\times\left(\frac{1}{\sqrt{3+3}}\right)^{6\times2^n}.$$

$$=\left(\frac{1}{2}\right)^{2^{n+1}}\times\left(\frac{1}{2}\right)^{22\times2^n-7}\times\left(\frac{1}{5}\right)^{14\times2^n-3}\times\left(\frac{1}{6}\right)^{3\times2^n}.$$

V. REFERENCES

[1] V.R.Kulli, *College Graph Theory*, Vishwa International Publications, Gulbarga, India (2012).
[2] R.Todeschini and V. Consonni, *Molecular Descriptors for Chemoinformatics*, Wiley-VCH, Weinheim, (2009).
[3] V.R. Kulli, On multiplicative connectivity indices of certain nanotubes, *Annals of Pure and Applied Mathematics*, 12(2) (2016), 169-176.
[4] V.R. Kulli, Multiplicative connectivity indices of $TUC_4C_8[m,n]$ and $TUC_4[m,n]$ nanotubes, *Journal of Computer and Mathematical Sciences*, 7(11) (2016) 599-605.
[5] V.R. Kulli, General multiplicative Zagreb indices of $TUC_4C_8[m, n]$ and $TUC_4[m, n]$ nanotubes, *International Journal of Fuzzy Mathematical Archive*, 11(1) (2016) 39-43.
[6] V.R. Kulli, On multiplicative *K* Banhatti and multiplicative *K* hyper-Banhatti indices of *V*-Phenylenic nanotubes and nanotorus, *Annals of Pure and Applied Mathematics*, 11(2) (2016) 145-150.
[7] V.R. Kulli, On *K* hyper-Banhatti indices and coindices of graphs, *International Journal of Mathematical Archive*, 7(6) (2016) 60-65.
[8] V.R.Kulli, Two new multiplicative atom bond connectivity indices, *Annals of Pure and Applied Mathematics*, 13(1) (2017) 1-7. DOI:http://dx.doi.org/10.22457/apam.vl3nlal.
[9] V.R.Kulli, Multiplicative connectivity indices of nanostructures, *Journal of Ultra Scientist of Physical Sciences*, A 29(1) (2017) 1-10. DOI:http://dx.doi-org/10.22147/jusps.A/290101.
[10] V.R.Kulli, A new multiplicative arithmetic-geometric index, *International Journal of Fuzzy Mathematical Archive*, 12(2) (2017) 49-53. DOI:http://dx.doi.org/10.22457/ijfma.v12n2a1.
[11] V.R.Kulli, Some new multiplicative geometric-arithmetic indices, *Journal of Ultra Scientist of Physical Sciences*, A, 29(2) (2017) 52-57. DOI:http://dx.doi.org/10.22147/jusps-A/290201.
[12] V.R.Kulli, New multiplicative inverse sum indeg index of certain benzenoid systems, *Journal of Global Research in Mathematical Archives*, 4(10) (2017) 15-19.

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Impact Factor: 5.164
CODEN: IJESS7

[13] V.R.Kulli, New multiplicative arithmetic-geometric indices, *Journal of Ultra Scientist of Physical Sciences*, A, 29(6) (2017) 205-211. DOI: http://dx.doi.org/10.22147/jusps-A/290601.
[14] V.R. Kulli, Multiplicative Revan and multiplicative hyper-Revan indices of certain networks, *Journal of Computer and Mathematical Sciences*, 8(12) (2017) 750-757.
[15] V.R. Kulli, Multiplicative connectivity Revan indices of polycyclic aromatic hydrocarbons and benzenoid systems, submitted.
[16] V.R. Kulli, Multiplicative atom bond connectivity and multiplicative geometric-arithmetic indices of dendrimer nanostars, submitted.
[17] V.R.Kulli, Edge version of multiplicative connectivity indices of some nanotubes and nanotorus, *International Journal of Current Research in Science and Technology*, 3(11) (2017) 7-15.
[18] V.R. Kulli, The product connectivity Gourava index, *Journal of Computer and Mathematical Sciences,* 8(9) (2017) 235-242.
[19] V.R.Kulli, On the sum connectivity Gourava index, *International Journal of Mathematical Archive,* 8(7)(2017) 211-217.
[20] V.R. Kulli, On the product connectivity reverse index of silicate and hexagonal networks, *International Journal of Mathematics and its Applications,* 5(4-B) (2017) 175-179.
[21] V.R. Kulli, On the sum connectivity reverse index of oxide and honeycomb networks, *Journal of Computer and Mathematical Sciences*, 8(9) (2017) 408-413.
[22] V.R. Kulli, Atom bond connectivity reverse and product connectivity reverse indices of oxide and honeycomb networks, *International Journal of Fuzzy Mathematical Archive,* 15(1) (2018) 1-5.
[23] V.R. Kulli, The sum connectivity Revan index of silicate and hexagonal networks, *Annals of Pure and Applied Mathematics*, 14(3) (2017) 401-406.
[24] V.R. Kulli, On the product connectivity Revan index of certain nanotubes, *Journal of Computer and Mathematical Sciences,* 8(10) (2017) 562-567.
[25] V.R.Kulli, B.Chaluvaraju and H.S.Boregowda, Some degree based connectivity indices of Kulli cycle windmill graphs, *South Asian Journal of Mathematics,* 6(6) (2016) 263-268.
[26] V.R. Kulli, General topological indices of some dendrimer nanostars, *Journal of Global Research in Mathematical Archives*, 4(11) (2017) 83-90.
[27] A.R.Ashrafi and P. Nikzad, Connectivity index of the family of dendrimer nanostars, *Digest Journal of Nanomaterials and Biostructures*, 4(2) (2009) 269-273

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