

Comparative Study of M and NM Polynomials of Ganciclovir and Famciclovir Used in HSV Therapy

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ABSTRACT

This paper presents a comparative study of the antiviral drugs Famciclovir and Ganciclovir using M-polynomial and NM-polynomial methods from chemical graph theory. The molecular graphs of both drugs are constructed, and several degree-based topological indices are derived from the corresponding polynomials. The results show that Famciclovir possesses higher polynomial coefficients and index values, indicating greater structural complexity and branching compared to Ganciclovir. This study demonstrates the effectiveness of polynomial-based topological indices in analyzing and comparing antiviral drug structures.

KEYWORDS: Degree based topological index, M-polynomial, NM-polynomial, Chemical graph theory, Antiviral drugs

AMS Subject Classification: 05C07, 05C09, 05C92

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INTRODUCTION

Chemical graph theory models molecular structure as graphs, where vertices represent chemical bonds. From these molecular graphs, degree-based topological indices are derived to numerically characterize structural properties such as connectivity and branching. These indices play an important role in QSPR / QSAR studies and pharmaceutical chemistry. Herpes virus infection, including those caused by cytomegalovirus (CMV), herpes simplex virus (HSV), and varicella-zoster virus (VZV), remain a significant global health concern, particularly among immunocompromised patients [1]. Antiviral agents such as ganciclovir and famciclovir are widely used for the treatment and management of these infections due to their proven clinical efficacy [2]. Ganciclovir is prevention of CMV infections and has demonstrated strong antiviral activity; however, its long-term use is often associated with drug toxicity, adverse side effects, and the development of viral resistance [3]. In contrast, famciclovir, a prodrug of penciclovir, is commonly used for the treatment of HSV and VZV infections and is known for its favorable pharmacokinetic profile and improved patient

tolerance [4]. Despite their therapeutic importance, the routine use of ganciclovir and famciclovir as monotherapies has contributed to the emergence of resistant viral strains, thereby limiting treatment effectiveness [5]. Owing to their different mechanisms of activation and interaction with viral DNA polymerase, comparative and combination-based treatment strategies involving these antiviral agents have been suggested as potential approaches to overcoming antiviral resistance [6]. Therefore, a comprehensive investigation of the molecular structure and properties of ganciclovir and famciclovir is essential. In this regard, chemical graph theory offers a robust mathematical framework for modeling molecular structures and analyzing drug behavior through degree-based topological indices derived from M-polynomial and NM-polynomial formulations [7,8].

Famciclovir is an antiviral medication used to treat infections caused by herpes viruses, including shingles (herpes zoster), cold sores (herpes labialis), and genital herpes. It works by stopping viral multiplication, reducing the duration and severity of

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outbreaks. Common side effects include headaches, nausea, and dizziness.



Figure 1

It most effective when initiated as soon as possible after the first symptoms (tingling, itching, burning) appear. Typically taken as a tablet with or without food, three times daily for 7 days for shingles, or as a one-day dose for cold sores. Famciclovir does not cure herps or completely prevent transmission to others.

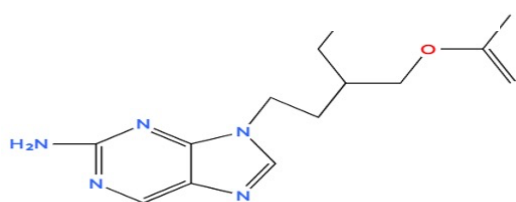
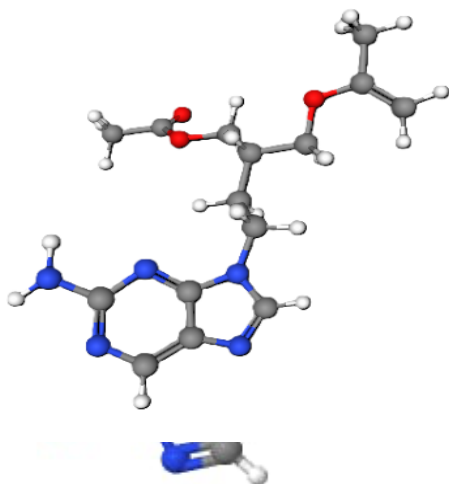


Figure 2. Structure of Famciclovir C₁₄H₁₉N₅O₄

Ganciclovir treatment is an antiviral therapy primarily used for serious infections caused by Cytomegalovirus (CMV), especially in immunocompromised individuals (like those with advanced HIV/AIDS or transplant recipients) for conditions like CMV retinitis (eye infection) or to prevent CMV disease. It works by stopping the virus from multiplying, often administered

intravenously, with careful dosing for induction and maintenance, but requires close blood monitoring due to potential severe side effects, especially low blood cell counts.

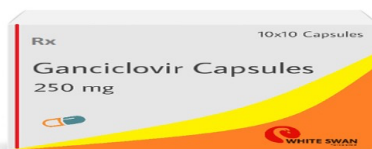


Figure 3

GANCICLOVIR USES:

- ▶ Treatment in AIDS patients.
- ▶ Prevention in solid organ or bone marrow transplant patients.
- ▶ Sometimes used for other serious CMV infections.

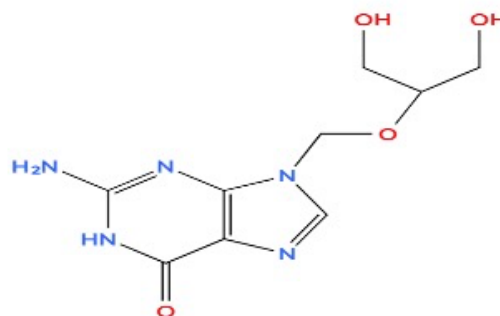


Figure 4. Structure of Ganciclovir C₉H₁₉N₅O₄

METHOD AND ANALYSIS:

Let $G = (V, E)$ be a simple, connected molecular graph, where $V(G)$ denotes the set of vertices representing atoms and $E(G)$ denotes the set of edges representing chemical bonds between atoms. The degree of a vertex $u \in V(G)$, denoted by $d(u)$, is the number of vertices adjacent to u . Graph polynomials play an important role in chemical graph theory, as they encode structural information of molecular graphs and are widely used to derive degree-based topological descriptors (TDs). These descriptors have proven applications in chemistry, biology, and pharmaceutical sciences [1-4].

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DEGREE PARTITION

For a given graph G, we partition the vertex set according to vertex degrees as follows;

$$V_i = \{v \in V(G) | d(v) = i\}, |V_i| = n_i.$$

Let $m_{ij} = |E_{ij}|$, where $E_{ij} = \{uv \in E(G) | d(u) = i, d(v) = j\}$,

$\overline{m}_{ij} = |\overline{E}_{ij}|$, where $\overline{E}_{ij} = \{uv \notin E(G) | d(u) = i, d(v) = j\}$

The M- polynomial [5] of a graph G is defined as

$$M(G; x, y) = \sum_{i \leq j} m_{ij}(G) x^i y^j,$$

Where $m_{ij}(G)$, $i, j \geq 1$ be the number of edges $uv \in E(G)$ such that $\{(d(u), d(v)) = (i, j)\}$

Let δ_v represent the neighborhood degree of v in the graph G, that is, $\delta(v) = \sum_{u \in N(v)} d(u)$, where $N(v)$

being the set of adjacent vertices of u.

Let $\chi_{i,j}(G)$; $i, j \geq 1$ be the number of edges $e = uv$ of G such that $\{\delta(u), \delta(v) = \{i, j\}\}$

Then the NM- polynomial [19,20and 21] of graph G is defined as

$$NM(G; x, y) = \sum_{i \leq j} \chi_{i,j}(G) x^i y^j.$$

FORMULATION OF SOME DEGREE-BASED TOPOLOGICAL DESCRIPTORS

In this section, some degree-based and neighborhood degree-based topological descriptors (TDs) and their association with the M-polynomial and NM-polynomial of a graph G are presented.

Let

$$F(x, y) = M(G; x, y) \text{ or } f(x, y) = NM(G; x, y)$$

We define the following differential and integral operators:

$$D_x = x \frac{\partial (f(x,y))}{\partial x}, D_y = x \frac{\partial (f(x,y))}{\partial y}, S_x = \int_0^x \frac{f(t,y)}{t} dt, S_y = \int_0^y \frac{f(x,t)}{t} dt,$$

$$J(f(x, y)) = f(x, x), Q_k(f(x, y)) = x^k f(x, y)$$

Using the above operators, various degree-based and neighborhood degree-based topological indices can be derived from the M-polynomial and NM-polynomial of a graph.

Table 1. Description of some degree-based topological Descriptors

Degree-based topological indices	Mathematical expression	Derived from M (G; x, y)
First Zagreb index	$\sum_{uv \in E(G)} d(u) + d(v)$	$(D_x + D_y)$ (M (G, x, y)/x=1, y=1.

Second Zagreb index	$\sum_{uv \in E(G)} d(u) d(v)$	$(D_x * D_y)$ (M (G, x, y)/x=1, y=1.
F- index	$\sum_{uv \in E(G)} (d^2(u) + d^2(v))$	$(D_x^2 + D_y^2)$ (M (G, x, y)/x=1, y=1.
Second modified Zagreb index	$\sum_{uv \in E(G)} \frac{1}{d(u)d(v)}$	$(S_x * S_y)$ (M (G, x, y)/x=1, y=1.
Symmetric Division index	$\sum_{uv \in E(G)} \frac{d^2(u) + d^2(v)}{d(u)d(v)}$	$(D_x S_y + S_x D_y)$ (M (G, x, y)/x=1, y=1.
Harmonic index	$\sum_{uv \in E(G)} \frac{2}{d(u) + d(v)}$	$(2S_x J)$ (M (G, x, y)/x=1, y=1.
Inverse sum index	$\sum_{uv \in E(G)} \frac{d(u)d(v)}{d(u) + d(v)}$	$(S_x J D_x D_y)$ (M (G, x, y)/x=1, y=1.
Augmented Zagreb index	$\sum_{uv \in E(G)} \left(\frac{d(u)d(v)}{d(u) + d(v)} - \frac{d(u)d(v)}{d(u)d(v)} \right)$	$(S_x^3 Q_{-2} D_x^3 D_y^3)$ (M (G, x, y)/x=1, y=1.

Table 2. Description of some Neighborhood degree-based topological descriptors

Neighborhood degree-based topological indices	Mathematical Expression	Derivative of NM (G; x, y)
Neighborhood First Zagreb index	$\sum_{uv \in E(G)} d(u) + d(v)$	$(D_x + D_y)$ (NM (G, x, y)/x=1, y=1.
Neighborhood Second Zagreb index	$\sum_{uv \in E(G)} d(u) d(v)$	$(D_x * D_y)$ (NM (G, x, y)/x=1, y=1.
Neighborhood F-index	$\sum_{uv \in E(G)} (d^2(u) + d^2(v))$	$(D_x^2 + D_y^2)$ (NM (G, x, y)/x=1, y=1.

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Neighborhood Second modified Zagreb index	$\sum_{uv \in E(G)} \frac{1}{d(u)d(v)}$	($S_x * S_y$) (NM (G, x, y))/x=1, y=1.
Neighborhood Symmetric Division index	$\sum_{uv \in E(G)} \frac{d^2(u) + d^2(v)}{d(u)d(v)}$	($D_x S_y + S_x D_y$) (NM (G, x, y))/x=1, y=1.
Neighborhood Harmonic index	$\sum_{uv \in E(G)} \frac{2}{d(u) + d(v)}$	($2S_x J$) (NM (G, x, y))/x=1, y=1.
Neighborhood Inverse sum index	$\sum_{uv \in E(G)} \frac{d(u)d(v)}{d(u) + d(v)}$	($S_x J D_x D_y$) (NM (G, x, y))/x=1, y=1.
Neighborhood Augmented Zagreb index	$\sum_{uv \in E(G)} \left(\frac{d(u)d(v)}{d(u) + d(v)} \right)$	($S_x^3 Q_{-2} D_x^3 D_y$) (NM (G, x, y))/x=1, y=1.

Lemma 1:

Let G be a simple connected graph with vertex partition

$$V_i = \{v \in V(G) \mid d(v) = i\}, |V_i| = n_i.$$

Let

$$E_{ij} = \{uv \in E(G) \mid d(u) = i, d(v) = j\}.$$

And

$$\overline{E}_{ij} = \{uv \notin E(G) \mid d(u) = i, d(v) = j\}.$$

Then, for $i \neq j$, $\overline{m}_{ij} = |\overline{E}_{ij}| = n_i n_j - m_{ij}$

And for $i = j$, $\overline{m}_{ii} = |\overline{E}_{ii}| = \binom{n_i}{2} - m_{ii}$.

Proof:

Let V_i and V_j be the sets of vertices of degrees i and j , respectively.

Case 1:

The total number of unordered vertex pairs (u, v) with $u \in V_i$ and $v \in V_j$ is $n_i n_j$.

Among these pairs, exactly m_{ij} are adjacent edges in $E(G)$.

Hence, the remaining pairs are non-adjacent.

Therefore, $\overline{m}_{ij} = n_i n_j - m_{ij}$.

Case 2:

The total number of unordered vertex pairs within V_i is $\binom{n_i}{2}$.

Among these, pairs, m_{ij} pairs are adjacent. Thus, the number of non-adjacent pairs is

$$\overline{m}_{ij} = \binom{n_i}{2} - m_{ii}.$$

Theorem 1

Let G be the molecular graph of Famciclovir. We can obtain that $|V(G)| = 23$, $|E(G)| = 24$ then, the M-polynomial and NM-polynomial of G given by

- (i) $M(G; x, y) = 5xy^3 + 5x^2y^2 + 12x^2y^3 + 2x^3y^3$.
- (ii) $NM(G; x, y) = 30xy^3 + 50x^2y^2 + 65x^2y^3 + 19x^3y^3$.

Proof:

Let G denote the molecular graph of Famciclovir. We first classify the vertices of G according to their degrees and denote by V_i the set of vertices of degree i , where $|V_i| = n_i$.

(i) Edge partition and M-polynomial

Each edge of G is classified according to the degree pair $(d(u), d(v))$ of its end vertices. From the molecular structure of Famciclovir, the edge partition is obtained as follows:

$$m_{13} = |E_{13}| = 5, m_{22} = |E_{22}| = 5, m_{23} = |E_{23}| = 12, m_{33} = |E_{33}| = 2.$$

Using the definition of the M-polynomial,

$$M(G; x, y) = \sum_{i \leq j} m_{ij} x^i y^j, \text{ We obtain}$$

$$M(G; x, y) = 5xy^3 + 5x^2y^2 + 12x^2y^3 + 2x^3y^3.$$

(ii) Non-adjacent pair partition and NM-polynomial

Let \overline{m}_{ij} denote the number of non-adjacent vertex pairs of degree (i, j) .

The vertex set can be partition into subsets, namely

$$|V_1| = 5, |V_2| = 11, |V_3| = 7$$

Applying lemma 1, we obtain

$$\overline{m}_{13} = n_1 n_3 - m_{13} = 30$$

$$\overline{m}_{22} = n_2 n_2 - m_{22} = 50$$

$$\overline{m}_{23} = n_2 n_3 - m_{23} = 65$$

$$\overline{m}_{33} = n_3 n_3 - m_{33} = 19.$$

Hence, by the definition of the NM-polynomial,

$$NM(G; x, y) = \sum_{i \leq j} \overline{m}_{ij} x^i y^j, \text{ we have}$$

$$NM(G; x, y) = 30xy^3 + 50x^2y^2 + 65x^2y^3 + 19x^3y^3.$$

Now we present the numerical values of some degree-based topological indices of the molecular graph of Famciclovir, obtained from its M-polynomial and NM-polynomial. From Table 1, we obtain the following;

1. $(D_x + D_y)_{x=1, y=1} = |20xy^3 + 20x^2y^2 + 60x^2y^3 + 12x^3y^3|_{x=1, y=1} = 112$.
2. $(D_x D_y)_{x=1, y=1} = |15xy^3 + 20x^2y^2 + 72x^2y^3 + 18x^3y^3|_{x=1, y=1} = 125$.
3. $(D_x^2 + D_y^2)_{x=1, y=1} = |50xy^3 + 40x^2y^2 + 156x^2y^3 + 36x^3y^3|_{x=1, y=1} = 282$.

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4. $(S_x S_y)_{x=1,y=1} = \left| \frac{5}{3}xy^3 + \frac{5}{4}x^2y^2 + \frac{12}{6}x^2y^3 + \frac{2}{9}x^3y^3 \right|_{x=1,y=1} = 5.139.$
5. $(D_x S_y + S_x D_y)_{x=1,y=1} = \left| \frac{50}{3}xy^3 + 10x^2y^2 + 26x^2y^3 + 4x^3y^3 \right|_{x=1,y=1} = 56.67.$
6. $(2S_x J)_{x=1,y=1} = \left| 2.5x^4 + 2.5x^4 + 4.8x^5 + 1x^6 \right|_{x=1,y=1} = 10.46.$
7. $(S_x J D_x D_y)_{x=1,y=1} = \left| 3.75x^4 + 5x^4 + 14.4x^5 + 3x^6 \right|_{x=1,y=1} = 26.15.$
8. $(S_x^3 Q_{-2} D_x^3 D_y^3)_{x=1,y=1} = \left| 16.875x^4 + 40x^4 + 96x^5 + 22.78125x^6 \right|_{x=1,y=1} = 175.65625.$

Likewise, Table 2, we have the following

1. $(D_x + D_y)_{x=1,y=1} = \left| 120xy^3 + 200x^2y^2 + 325x^2y^3 + 114x^3y^3 \right|_{x=1,y=1} = 759.$
2. $(D_x D_y)_{x=1,y=1} = \left| 90xy^3 + 200x^2y^2 + 390x^2y^3 + 171x^3y^3 \right|_{x=1,y=1} = 851.$
3. $(D_x^2 + D_y^2)_{x=1,y=1} = \left| 300xy^3 + 400x^2y^2 + 845x^2y^3 + 342x^3y^3 \right|_{x=1,y=1} = 1887.$
4. $(S_x S_y)_{x=1,y=1} = \left| 10xy^3 + \frac{50}{4}x^2y^2 + \frac{65}{6}x^2y^3 + \frac{19}{9}x^3y^3 \right|_{x=1,y=1} = 35.4.$
5. $(D_x S_y + S_x D_y)_{x=1,y=1} = \left| 100xy^3 + 100x^2y^2 + \frac{845}{6}x^2y^3 + 38x^3y^3 \right|_{x=1,y=1} = 378.83.$
6. $(2S_x J)_{x=1,y=1} = \left| 15x^4 + 25x^4 + 26x^5 + \frac{19}{3}x^6 \right|_{x=1,y=1} = 72.33.$
7. $(S_x J D_x D_y)_{x=1,y=1} = \left| 22.5x^4 + 50x^4 + 78x^5 + 28.5x^6 \right|_{x=1,y=1} = 179.$
8. $(S_x^3 Q_{-2} D_x^3 D_y^3)_{x=1,y=1} = \left| \frac{810}{8}x^4 + 400x^4 + 520x^5 + \frac{13851}{64}x^6 \right|_{x=1,y=1} = 1237.64$

Theorem 2:

Let G be the molecular graph of Ganciclovir. We can obtain that $|V(G)| = 17$, $|E(G)| = 18$ then, the M-polynomial and NM-polynomial of G are given by

- (i) $M(G; x, y) = 2xy^2 + 2xy^3 + 2x^2y^2 + 10x^2y^3 + 3x^3y^3$
- (ii) $NM(G; x, y) = 30xy^2 + 22xy^3 + 26x^2y^2 + 38x^2y^3 + 12x^3y^3$

Proof:

Let G denote the molecular graph of Ganciclovir. The vertices of G are first classified according to their degrees, and let V_i denote the set of vertices of degree i, where $|V_i| = n_i$.

(i) Edge partition and M-polynomial

Each edge of G is classified based on the degree pair $(d(u), d(v))$ of its end vertices. From the molecular structure of Ganciclovir, the following edge partition is obtained:

$$m_{12} = |E_{12}| = 2, \quad m_{13} = |E_{13}| = 2, \quad m_{22} = |E_{22}| = 2, \quad m_{23} = |E_{23}| = 10, \quad m_{33} = |E_{33}| = 3,$$

Using the definition of the M-polynomial,

$M(G; x, y) = \sum_{i \leq j} m_{ij} x^i y^j$, We obtain

$$M(G; x, y) = 2xy^2 + 2xy^3 + 2x^2y^2 + 10x^2y^3 + 3x^3y^3$$

(ii) Non-adjacent pair partition and NM-polynomial

Let \overline{m}_{ij} denote the number of non-adjacent vertex pairs of degree (i, j) . Let \overline{m}_i denote the number of non-adjacent vertex pairs of degree (i, i) .

The vertex set can be partition into subsets, namely $|V_1| = 4$, $|V_2| = 8$, $|V_3| = 6$

Applying lemma 1, we obtain

$$\overline{m}_{12} = n_1 n_2 - m_{12} = 30,$$

$$\overline{m}_{13} = n_1 n_3 - m_{13} = 22,$$

$$\overline{m}_{22} = n_2 n_2 - m_{22} = 26,$$

$$\overline{m}_{23} = n_2 n_3 - m_{23} = 38,$$

$$\overline{m}_{33} = n_3 n_3 - m_{33} = 12.$$

Hence, by the definition of the NM-polynomial,

$NM(G; x, y) = \sum_{i \leq j} \overline{m}_{ij} x^i y^j$, We have

$$NM(G; x, y) = 30xy^2 + 22xy^3 + 26x^2y^2 + 38x^2y^3 + 12x^3y^3.$$

Now we present the numerical values of some degree-based topological indices of the molecular graph of Ganciclovir, obtained from its M-polynomial and NM-polynomial. From Table 1, we obtain the following;

1. $(D_x + D_y)_{x=1,y=1} = \left| 6xy^2 + 8xy^3 + 8x^2y^2 + 50x^2y^3 + 18x^3y^3 \right|_{x=1,y=1} = 90.$
2. $(D_x D_y)_{x=1,y=1} = \left| 4xy^2 + 6xy^3 + 8x^2y^2 + 60x^2y^3 + 27x^3y^3 \right|_{x=1,y=1} = 105.$
3. $(D_x^2 + D_y^2)_{x=1,y=1} = \left| 10xy^2 + 20xy^3 + 16x^2y^2 + 130x^2y^3 + 54x^3y^3 \right|_{x=1,y=1} = 230.$
4. $(S_x S_y)_{x=1,y=1} = \left| xy^2 + \frac{2}{3}xy^3 + \frac{1}{2}x^2y^2 + \frac{5}{3}x^2y^3 + \frac{1}{3}x^3y^3 \right|_{x=1,y=1} = 4.17.$
5. $(D_x S_y + S_x D_y)_{x=1,y=1} = \left| 5xy^2 + \frac{20}{3}xy^3 + 4x^2y^2 + \frac{65}{3}x^2y^3 + 6x^3y^3 \right|_{x=1,y=1} = 38.33.$
6. $(2S_x J)_{x=1,y=1} = \left| \frac{4}{3}x^3 + x^4 + x^4 + 4x^5 + x^6 \right|_{x=1,y=1} = 8.33.$
7. $(S_x J D_x D_y)_{x=1,y=1} = \left| \frac{4}{3}x^3 + \frac{3}{2}x^4 + 2x^4 + 12x^5 + \frac{9}{2}x^6 \right|_{x=1,y=1} = 21.33.$

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$$8. (S_x^3 Q_{-2} D_x^3 D_y^3)_{x=1,y=1} = |16x^3 + \frac{27}{4}x^4 + 16x^4 + 80x^5 + \frac{2187}{67}x^6|_{x=1,y=1} = 151.3917.$$

Likewise, Table 2, we have the following;

1. $(D_x + D_y)_{x=1,y=1} = |90xy^2 + 88xy^3 + 104x^2y^2 + 190x^2y^3 + 72x^3y^3|_{x=1,y=1} = 544.$
2. $(D_x D_y)_{x=1,y=1} = |60xy^2 + 66xy^3 + 104x^2y^2 + 228x^2y^3 + 108x^3y^3|_{x=1,y=1} = 566.$
3. $(D_x^2 + D_y^2)_{x=1,y=1} = |150xy^2 + 220xy^3 + 208x^2y^2 + 494x^2y^3 + 216x^3y^3|_{x=1,y=1} = 1288.$
4. $(S_x S_y)_{x=1,y=1} = |15xy^2 + 7.333xy^3 + 6.5x^2y^2 + 6.333x^2y^3 + 1.333x^3y^3|_{x=1,y=1} = 36.50.$
5. $(D_x S_y + S_x D_y)_{x=1,y=1} = |75xy^2 + 73.333xy^3 + 52x^2y^2 + 82.333x^2y^3 + 24x^3y^3|_{x=1,y=1} = 306.67.$
6. $(2S_x J)_{x=1,y=1} = |20x^3 + 11x^4 + 13x^4 + 15.2x^5 + 4x^6|_{x=1,y=1} = 63.2.$
7. $(S_x J D_x D_y)_{x=1,y=1} = |20x^3 + 16.5x^4 + 26x^4 + 45.6x^5 + 18x^6|_{x=1,y=1} = 126.1.$
8. $(S_x^3 Q_{-2} D_x^3 D_y^3)_{x=1,y=1} = |240x^3 + 74.25x^4 + 208x^4 + 304x^5 + 136.69x^6|_{x=1,y=1} = 962.9.$

Table 3: Numerical comparison of degree-based topological indices of M-polynomial

Index	Famciclovir (M)	Ganciclovir (M)	Dominance
First Zagreb index	112	90	Famciclovir
Second Zagreb index	125	105	Famciclovir
F- index	282	230	Famciclovir
Second modified Zagreb index	5.139	4.17	Famciclovir
Symmetric division index	56.67	38.33	Famciclovir
Harmonic index	10.46	8.33	Famciclovir

Inverse sum index	26.15	21.33	Famciclovir
Augmented Zagreb index	175.65625	151.3917	Famciclovir

Table 4: Comparison of degree based topological indices of NM-polynomial

Index	Famciclovir (NM)	Ganciclovir (NM)	Dominance
First Zagreb index	759	544	Famciclovir
Second Zagreb index	851	566	Famciclovir
F- index	1887	1288	Famciclovir
Second modified Zagreb index	35.4	36.50	Ganciclovir
Symmetric Division index	378.83	306.67	Famciclovir
Harmonic index	72.33	63.2	Famciclovir
Inverse sum index	179	126.1	Famciclovir
Augmented Zagreb index	1237.64	962.9	Famciclovir

Figure 5. Bar-chart comparison of the degree-based topological indices derived from the M-polynomial for the molecular graphs of Famciclovir and Ganciclovir.

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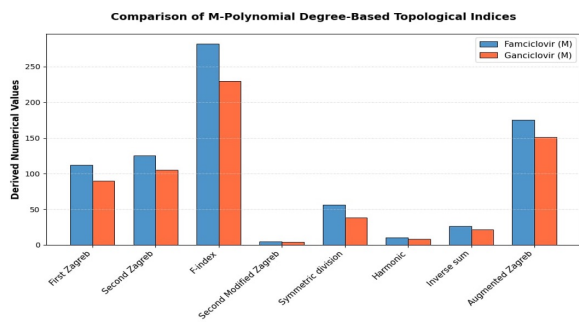
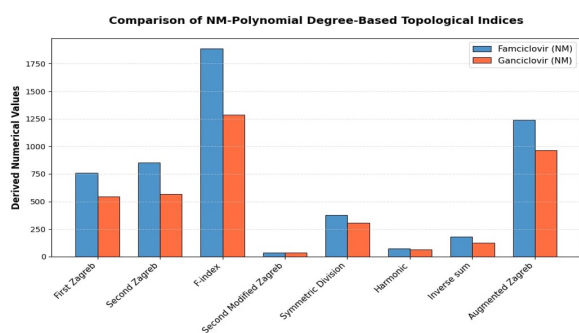


Figure 6. Bar-chart comparison of the degree-based topological indices derived from the NM-polynomial for the molecular graphs of Famciclovir and Ganciclovir.



CONCLUSION:

The comparative numerical analysis of the degree-based topological indices obtained from the M-polynomial shows that the values of M_1 , M_2 , F, RM_2 , SD, H, ISI and AZI for Famciclovir are higher than the corresponding values of Ganciclovir. This indicates that the molecular graph of Famciclovir possesses comparatively greater structural connectivity and branching characteristics. Therefore, based on the computed M-polynomial indices, Famciclovir exhibits dominance over Ganciclovir in the topological comparison. The result confirm that M-polynomial-based topological descriptors provide an effective mathematical tool for distinguishing and comparing the structural properties of antiviral drug molecular graphs.

References:

1. F. Harary, Graph Theory, Addison-Wesley, Reading Mass (1969).
2. De Clercq, E. (2004). Antiviral drugs in current clinical use. *Journal of Clinical Virology*, 30(2), 115-133.
3. Elion, G. B. (1983). The biochemistry and mechanism of action of acyclovir. *Journal of Antimicrobial chemotherapy*, 12(Suppl B), 9-17.
4. De Clercq, E., & Li, G. (2016). Approved antiviral drugs over the past 50 years. *Clinical Microbiology Reviews*, 29(3), 695-747.

5. Lurain, N. S., & Chou, S. (2010). Antiviral drug resistance of human cytomegalovirus. *Clinical Microbiology Reviews*, 23(4), 689-712.
6. Earnshaw, D. L., et al. (1992). Penciclovir and famciclovir: antiviral activity and clinical applications. *Antiviral Chemistry & Chemotherapy*, 3, 189-202.
7. Gilbert, C., et al. (2002). Resistance of herpesviruses to antiviral drugs. *Antiviral Research*, 56(3), 227-245.
8. Chou, S. (2001). Mechanisms of antiviral drug resistance. *Clinical Infectious Diseases*, 33(4), 577-582.
9. Deutsch, E., & Klavzar, S. (2015). M-polynomial and degree-based topological indices. *Iranian Journal of Mathematical Chemistry*, 6(2), 93-102.
10. Gutman, I. (2013). Degree-based topological indices. *Croatica Chemica Acta*, 86(4), 351-361.
11. Parameshwari, S., & Balasangu, K. (2025). Graph polynomial approach for some molecules in H1N1 antiviral drugs. *Utilitas Mathematica*, 122, 1881-1895.