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QSAR Study Of Neoplastic Drugs Of Triazine Series With The Help Of Quantum Chemical And Energy Descriptors

R.B.Srivastava
Department of Mathematics,
M. L. K. (P. G.) College Balrampur,
U. P. (INDIA)
E-mail: ram_bux@yahoo.co.in

P.P.Singh, S.Singh
Department of Chemistry,
Bareilly College,
Bareilly, U. P. (INDIA)

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ABSTRACT

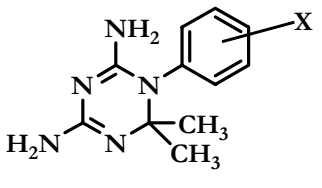
Quantum chemical descriptors such as chemical potential, electronegativity, eigen values of HOMO, eigen values of LUMO, absolute hardness, global softness and energy descriptors such as heat of formation, total energy, electronic energy, core-core repulsion, based QSAR study of 47 derivatives of triazine have been made with the help of PM3 calculations on Win MOPAC 7.21 software. The 3D modeling and geometry optimization have been done with the same software. The biological activity has been taken from literature. Multi Linear Regression analysis has been made with the help of above descriptors in 36 combinations, out of which 23 combinations have been found to provide successful models, as the predicted activity is very close to observed activity. εHOMO has been noticed as best quantum chemical descriptor and heat of formation, electronic energy and core-core repulsion as best energy descriptors. With the help of these combinations the biological activity of any triazine derivative can be predicted reliably.

KEYWORDS

QSAR;
MLR;
Energy descriptors;
Quantum chemical descriptors;
Triazines.

INTRODUCTION

Baker and his few graduate students[1] synthesized about 260 variations of compund-1 and studied their inhibiting effect on dihydrofolate reductase isolated from Walker 256 and L1210 Leukemia tumors. This study appears to constitute the largest



Compound-1

published set of biochemical congeners whose activity has been measured quantitatively in one laboratory.

Hansch[2] formulated in a first attempt the following equation for QSAR study of the derivatives of compound-1 using molar refractivity (MR) as descriptor.

$\log I/C = 0.89\ (\pm 0.14)\ (\pi\text{-}3) - 1.3\ (\pm 0.03)\ (\pi\text{-}3)^2 + 0.15\ (\pm 0.03)\ (MR\text{-}4) + 6.62\ (\pm 0.13)$

Quantum chemical[3] and energy descriptors[4-6] have been prominently used for QSAR study in the last decade. We in this paper present QSAR study of 47 derivatives of compound-1 with the help of quantum chemical and energy descriptors.

MATERIAL AND METHOD

47 descriptors of compound-1 have been taken as study material. They are listed in two groups in TABLES 1-2 alongwith their biological activity in terms of log I/C, where C is molar concentration of inhibitor causing 50% reversible inhibition of enzyme.

Enzyme dihydrofolate reductase isolated from Leukemia tumor forms covalatent bond with highly reactive derivatives of triazines. The compounds are strongly electrophilic, react through carbonium ion intermediate and form covalent bonds with amino, hydroxyl, carboxyl groups[7]. Consequences are (i) bifunctional agents (ii) DNA-DNA strand and DNA protein cross links.

For QSAR prediction, the 3D modeling and geometry optimization of all the derivatives of triazine have been done with the help of PCMODEL software using the semiempirical PM3 Hamiltonian. The MOPAC calculations were performed with Win MOPAC 7.21 software by applying key words Charge=0, Gnorm-0.1, Bonds, Geo-ok, vector density.

The values of quantum chemical descriptors such as HOMO[8], LUMO[9], absolute hardness[10-11], global softness[12], chemical potential[13], electronegativity[14] were evaluated by solving the equations given below. The values of energy descriptors were evaluated from PM3 results.

Parr et al[15] define the electronegativity as the negative of chemical potential :-

$$\chi = -\mu = -\left(\partial E/\partial N\right)_v \quad (1)$$

The absolute hardness η is defined as[16]

$$\eta = 1/2(\delta\mu/\delta N)v_{(r)} = 1/2\ (\delta^2E/\delta^2N)v_{(r)} \quad (2)$$

where E is the total Energy, N the number of electrons of the chemical species and $v_{(r)}$ the external potential.

The corresponding global softness S, which bears an inverse relationship with the global hardness is defined as

$$S = 1/2\eta = (\partial N/\partial\mu)v_{(r)} \quad (3)$$

The operational definition of absolute hardness, global softness and electronegativity is defined as:

$$\eta = 1/2\ (IP\text{-}EA) \quad (4)$$

$$S = 1/(IP\text{-}EA) \quad (5)$$

$$\chi = -\mu = 1/2(IP + EA) \quad (6)$$

where IP and EA are the Ionization Potential and Electron Affinity respectively, of the chemical species. According to the Koopman's theorem the IP is simply the eigen value of HOMO with change of sign and EA is the eigen value of LUMO with change of sign[15], hence, Eqs. 4-6 can be written as

$$\eta = 1/2\ (\varepsilon\ LUMO - \varepsilon\ HOMO) \quad (7)$$

$$S = 1/(\varepsilon\ LUMO - \varepsilon\ HOMO) \quad (8)$$

$$\chi = 1/2\ (\varepsilon\ LUMO + \varepsilon\ HOMO) \quad (9)$$

The energy descriptors[17-20] are useful parameters for describing QSAR of a chemical system. A more useful quantity is the heat of formation of the compound from its elements in their standard state. This is equal to the energy required to ionize the valence electrons of the atoms involved. The heat of formation is defined as

$$\Delta H_f = E_{elect} + E_{nuc} - E_{isol} + E_{atom} \quad (10)$$

Where E_{elect} is the electronic energy, E_{nuc} is the nuclear-nuclear repulsion energy, E_{isol} is the energy required to strip all the valence electrons of all the atoms in the system and E_{atom} is the total heat of atomization of all the atoms in the system.

Total energy of a molecular system is the sum of the total electronic energy, E_{ee} and the energy of internuclear repulsion, E_{nr}.

The total electronic energy of the system is given by:

$$E = 1/2P(H + F) \quad (11)$$

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Where P is the density matrix and H is the one electron matrix. These parameters and the charges on atoms were obtained from PM3[21] calculations.

Multi linear regression (MLR) analysis has been performed by using Project Leader program associated with Cache Pro software of Fujitsu.

RESULT AND DISCUSSION

The triazine derivatives have been divided into two groups. The first set consists of 21 and the second set consists of 26 derivatives. This division is based on the difference in position of the substituents. The two sets are included in TABLES 1-2 alongwith their biological activity in terms of log I/C. For QSAR study quantum chemical descriptors and energy descriptors have been used. The values of quantum chemical descriptor of first set of compounds are presented in TABLE-3 and of energy descriptors in TABLE-4. Similarly for the second set of 26 compounds the quantum chemical and energy

TABLE 1: Containing first set of 21 derivatives of triazine with their observed biological activity in terms of log I/C_{50} values

No.	Derivatives	log1/C
1	2,5-Cl_2	4.22
2	2-OCH_3	4.22
3	2,4-Cl_2	4.326
4	2-CH_3	4.22
5	2-Cl	4.22
6	2-Br	4.22
7	2,4,5-Cl_3	4.326
8	2-I	4.22
9	4-$CONHC_6H_4$-4'-SO_2F	5.272
10	4-$CONHC_6H_4$-3'-SO_2F	5.272
11	4-C_6H_5	5.161
12	2-F	4.22
13	3OCH_2-CO-N-$(CH_2CH_2)_2O$	5.576
14	4-CN	6.862
15	4-CH=CHCONH-C_6H_4-4'-SO_2F	5.272
16	3-OCH_2CONMe_2	5.606
17	4-CH(Ph)CH_2CONH-C_6H_4-4'-SO_2F	5.078
18	4-Cl,3-$(CH_2)_2C_6H_4$-4'-SO_2F	8.28
19	4-CH=CHCONH-C_6H_4-3'-SO_2F	5.272
20	3-$CONHC_6H_4$-4'-SO_2F	5.513
21	3-$NHCOCH_2$Br-4-O$(CH_2)_3C_6H_5$	6.993

TABLE 2: Containing second set of 26 derivatives of triazine with their observed biological activity in terms of log I/C_{50} values

S.No	Derivatives	Obsd log1/C
22	3-OCH_3	6.17
23	4-OCH_2CON-(Me)C_6H_5	6.17
24	4-$CH_2CH(CH_2CH_2Ph)$-$CONHC_6H_4$-4′-SO_2F	6.20
25	3-$COCH_2Cl$	6.21
26	4-$CH_2CH(\alpha$-$C_{10}H_7)$-$CONH_6H_4$-4′-SO_2F	6.24
27	4-OCH_2CONMe_2	6.26
28	4-CH_2CH-)Ph-2″-OCH_3) $CONH_6H_4$-4′-SO_2F	6.33
29	3-Cl,4-$OCH_2C_6H_{10}$-$CH_2OC_6H_4$-4′-SO_2F	6.37
30	3-$CH(CH_2NHCO$-$CH_2Br)(CH_2)_3C_6H_5$	6.37
31	3-CH_2NHCO-$N(CH_2CH_2)_2O$	6.43
32	4-CH_2CH(Ph-3″-OCH_3)$CONHC_6H_4$-4′CO_2F	6.46
33	4-$CH(CH_2NHCO$-$CH_2Br)(CH_2)_3C_6H_5$	6.52
34	2,3-Cl_2	6.52
35	2-Cl,4$(CH_2)_4C_6H_5$	6.54
36	3-Cl,4-0$(CH_2)_4$O-C_6H_4-4′-$SO_3C_6H_4$-4″-Cl	6.55
37	3-$CH_2NHCOCH_2Br$	6.58
38	3-$CONH_6H_4$-3′-SO_2F	6.60
39	4-CH_2CONMe_2	6.63
40	4-OCH_2CO-$N(CH_2)_4$	6.66
41	3-OCH_2CON(Me)C_6H_5	6.68
42	4-OCH_2CONEt_2	6.72
43	3-$CH_2CH(CH_2$-$NHCOCH_2Br)C_6H_5$	6.72
44	4-CH_2CONEt_2	6.77
45	4-Cl,3-$(CH_2)_4$-C_6H_4-4′-SO_2F	6.77
46	3-Cl,4-$OCH_2C_2H_4$-4′-$CH_2OC_2H_4$″-SO_2F	6.82
47	3-$OCH_2CONHC_6H_5$	6.85

TABLE 3: Containing quantum chemical descriptors of first set of triazine derivatives.

No.	εHOMO	εLUMO	η	S	μ	χ
1	-8.72396	-0.69318	4.01539	0.249041812	-4.70857	4.70857
2	-8.47526	-0.27639	4.099435	0.243936055	-4.378525	4.378525
3	-8.33336	-0.63425	3.849555	0.259770285	-4.483805	4.483805
4	-8.639	-0.23242	4.20329	0.237908876	-4.43571	4.43571
5	-8.67197	-0.47538	4.098295	0.244003909	-4.573675	4.573675
6	-8.67968	-0.4883	4.09569	0.244159104	-4.584255	4.584255
7	-8.75291	-0.87712	3.937895	0.253942779	-4.815015	4.815015
8	-8.67427	-0.69412	3.990075	0.250621855	-4.684195	4.684195
9	-8.94662	-1.34087	3.802875	0.262958946	-5.143745	5.143745
10	-8.8928	-1.21739	3.837705	0.260572399	-5.055095	5.055095
11	-8.62706	-0.78184	3.92261	0.254932303	-4.70445	4.70445
12	-8.67413	-0.54652	4.063805	0.246074799	-4.610326	4.610326
13	-8.73379	-0.4042	4.164795	0.240107856	-4.568995	4.568995
14	-8.86398	-1.05787	3.903055	0.256209559	-4.960925	4.960925
15	-8.89325	-1.48403	3.70461	0.269933947	-5.18864	5.18864
16	-8.71541	-0.34504	4.185185	0.238938064	-4.530226	4.530226
17	-8.49591	-0.97285	3.76153	0.265849269	-4.73438	4.73438
18	-8.8397	-0.92959	3.955055	0.252840985	-4.884645	4.884645
19	-8.85854	-1.40377	3.727385	0.268284602	-5.131135	5.131135
20	-9.06954	-1.19459	3.937475	0.253969866	-5.132065	5.132065
21	-8.50058	-0.61945	3.940565	0.253770716	-4.560015	4.560015

ε LUMO is eigen value of highest occupied molecular orbital , ε HOMO is eigen value of lowest un occupied molecular orbital , η is Absolute hardness.

TABLE 4: Containing energy descriptors of first set of triazine derivatives

No	ΔH_f^0	T_E	E_E	CCR
1	38.4667	-2948.17501	-20332.7	17384.52
2	13.51591	-2788.24888	-20646.46	17858.22
3	43.64576	-2947.95	-20257.9	17309.93
4	41.35956	-2495.1165	-18428.4	15933.25
5	45.18047	-2646.76	-18488.5	15841.78
6	59.19002	-2683.404	-18479.8	15796.35
7	34.19135	-3249.48	-22246.4	18996.91
8	79.45621	-2618.25	-18315	15996.76
9	-76.36017	-4905.69	-37690.8	32785.13
10	-74.66743	-4905.61	-38225.9	33320.31
11	73.08044	-3117.61	-24442.8	21325.16
12	7.53811	-2770.28	-18669.1	15898.83
13	-58.51877	-4238.27	-34834.5	30596.28
14	85.33146	-2609.73	-18511.9	15902.2
15	-64.09348	-5173.1	-40099.97	34926.87
16	-22.08616	-3676.82	-28919.5	25242.66
17	-56.58723	-5976.61	-58022.2	52045.6
18	-58.4211	-4916.23	-38957.7	34041.5
19	-62.99996	-5173.05	-40351	35177.96
20	-76.92815	-4905.71	-38707.4	33801.73
21	-1.15458	-4936.75	-42799.5	37862.69

ΔH_f^0 is the heat of formation, T_E is the total energy, EE is the electronic energy and CCR is the core-core repulsion.

descriptors are included in TABLE-5 and 6. For MLR analysis, each quantum chemical descriptor has been used as first descriptor in combination with one or two energy descriptor as second descriptor. The various combinations that have been tried are listed below-

AA1 eigen values of HOMO as first group descriptor and heat of formation as second group descriptor

AB1 eigen values of HOMO as first group descriptor and total energy as second group descriptor

AC1 eigen values of HOMO as first group descriptor and electronic energy as second group descriptor

AD1 eigen values of HOMO as first group descriptor and core-core repulsion as second group descriptor

AE1 eigen values of HOMO as first group descriptor and heat of formation and total energy as second group descriptors

AF1 eigen values of HOMO as first group descriptor and electronic energy and core-core repulsion as second group descriptors

BA2 eigen values of LUMO as first group descriptor and heat of formation as second group descriptor

BB2 eigen values of LUMO as first group descriptor and total energy as second group descriptor

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TABLE 5: Containing quantum chemical descriptors of second set of triazine derivatives

Comp.	εHOMO	εLUMO	η	S	μ	χ
22	-8.596131	-0.46122	4.067455	0.2458540	-4.528675	4.528675
23	-8.536841	-0.49385	4.021495	0.2486637	-4.515345	4.515345
24	-8.797630	-1.27608	3.760775	0.2659027	-5.036855	5.036855
25	-8.771230	-0.91866	3.926285	0.2546937	-4.844945	4.844945
26	-8.801770	-1.20816	3.796805	0.2633793	-5.004966	5.004966
27	-8.745650	-1.08578	3.829935	0.2611010	-4.915715	4.915715
28	-8.732580	-0.99441	3.869085	0.2584590	-4.863495	4.863495
29	-8.833919	-0.46331	4.185305	0.2389313	-4.648615	4.648615
30	-8.787140	-0.46247	4.162335	0.2402498	-4.624805	4.624805
31	-8.867460	-0.93926	3.964100	0.2522641	-4.903361	4.903361
32	-8.642680	-0.45856	4.092060	0.2443757	-4.550620	4.550620
33	-8.573760	-0.43521	4.069275	0.2457440	-4.504485	4.504485
34	-8.495321	-0.57002	3.962650	0.2523564	-4.532670	4.532670
35	-8.469990	-0.44616	4.011915	0.2492575	-4.458075	4.458075
36	-8.615680	-2.00045	3.307615	0.3023327	-5.308065	5.308065
37	-8.501429	-0.43565	4.032890	0.2479612	-4.468540	4.468540
38	-8.607240	-1.02464	3.791300	0.2637618	-4.815940	4.815940
39	-8.477520	-0.37021	4.053655	0.2466910	-4.423865	4.423865
40	-8.498241	-0.42678	4.035730	0.2477866	-4.462510	4.462510
41	-8.501630	-0.46996	4.015835	0.2490142	-4.485795	4.485795
42	-8.188940	-0.15085	4.019045	0.2488154	-4.169895	4.169895
43	-8.760750	-0.96703	3.896860	0.2566169	-4.863890	4.863890
44	-8.122020	-0.06473	4.028645	0.2482225	-4.093375	4.093375
45	-8.537780	-0.96716	3.785310	0.2641792	-4.752470	4.752470
46	-8.383470	-0.91197	3.735750	0.2676839	-4.647720	4.647720
47	-8.816379	-0.50427	4.156055	0.2406128	-4.660325	4.660325

ε LUMO is eigen value of Highest occupied molecular orbital, ε HOMO is eigen value of Lowest unoccupied molecular orbital, η is Absolute hardness

TABLE 6: Containing energy descriptors of second set of Triazine derivatives

Comp	ΔH_f^0	T_E	E_E	CCR
22	21.48518	-2787.9033	-20095.60342	17307.70012
23	21.86712	-4298.77762	-35553.15119	31254.37357
24	8.64529	-6272.39737	-58639.11598	52366.71861
25	7.7438	-3208.25899	-23035.9987	19827.73971
26	69.86604	-6447.81722	-62638.27975	56190.46253
27	73.43352	-6383.66621	-61961.18801	55577.5218
28	-49.83937	-6395.54071	-52487.63385	46092.09314
29	25.79306	-4792.96652	-43210.81665	38417.85013
30	-31.03728	-4122.99714	-34741.66663	30618.66949
31	7.17778	-3208.28353	-22794.80484	19586.52131
32	27.29496	-5221.02119	-49358.86217	44317.84098
33	32.60312	-4764.13038	-42204.41836	37440.28789
34	70.08687	-2946.80383	-20291.28656	17344.48274
35	89.1162	-3716.64395	-30045.39564	26328.75169
36	69.2382	-6736.36779	-58316.01881	51579.65101
37	29.75341	-3571.70431	-26256.98551	22685.2812
38	37.30903	-4900.75815	-38051.44229	33150.68414
39	16.34416	-3383.22476	-26370.04801	22986.82325
40	-17.30685	-3944.55513	-31581.92169	27637.36656
41	22.58013	-4298.7467	-35392.32277	31093.57607
42	-2.32566	-3974.57084	-32082.64511	28108.07727
43	-32.62293	-5946.87683	-47896.18776	41949.31093
44	21.67689	-3681.60506	-30122.86032	26441.25526
45	49.42271	-5210.16337	-41721.65516	36511.49178
46	30.65705	-6269.38863	-51754.37494	45304.98631
47	3.8744	-4150.25209	-36121.50064	31971.24855

ΔH_f^0 is the heat of formation, T_E is the total energy, EE is the electronic energy and CCR is the core-core repulsion.

BC2 eigen values of LUMO as first group descriptor and electronic energy as second group descriptor

BD2 eigen values of LUMO as first group descriptor and core-core repulsion as second group descriptor

BE2 eigen values of LUMO as first group descriptor and heat of formation and total energy as second group descriptors

BF2 eigen values of LUMO as first group descriptor and electronic energy and core-core repulsion as second group descriptors

CA3 absolute hardness as first group descriptor and heat of formation as second group descriptor

CB3 absolute hardness as first group descriptor and total energy as second group descriptor

CC3 absolute hardness as first group descriptor and electronic energy as second group descriptor

CD3 absolute hardness as first group descriptor and core-core repulsion as second group descriptor

CE3 absolute hardness as first group descriptor and heat of formation and total energy as second

group descriptors

CF3 absolute hardness as first group descriptor and electronic energy and core-core repulsion as second group descriptors

DA4 global softness as first group descriptor and heat of formation as second group descriptor

DB4 global softness as first group descriptor and total energy as second group descriptor

DC4 global softness as first group descriptor and electronic energy as second group descriptor

DD4 global softness as first group descriptor and core-core repulsion as second group descriptor

DE4 global softness as first group descriptor and heat of formation and total energy as second group descriptors

DF4 global softness as first group descriptor and electronic energy and core-core repulsion as second group descriptors

EA5 chemical potential as first group descriptor and heat of formation as second group descriptor

EB5 chemical potential as first group descriptor and total energy as second group descriptor

EC5 chemical potential as first group descriptor and electronic energy as second group descriptor

ED5 chemical potential as first group descriptor and core-core repulsion as second group descriptor

EE5 chemical potential as first group descriptor and heat of formation and total energy as second group descriptors

EF5 chemical potential as first group descriptor and electronic energy and core-core repulsion as second group descriptors

FA6 electronegativity as first group descriptor and heat of formation as second group descriptor

FB6 electronegativity as first group descriptor and total energy as second group descriptor

FC6 electronegativity as first group descriptor and electronic energy as second group descriptor

FD6 electronegativity as first group descriptor and core-core repulsion as second group descriptor

FE6 electronegativity as first group descriptor and heat of formation and total energy as second group descriptors

FF6 electronegativity as first group descriptor and electronic energy and core-core repulsion as second group descriptors

36 regression models from the above listed combinations have been attempted but only 23 models have been found successful for the first set of 21 compounds and 8 models for the second set of 26 compounds because in the remaining the values of cross validation coefficients are below 0.5, and the predicted activity is not close to observed activity. The various regression equations, which have been found successful, are listed below. 1-23 models are for the first set and 24-31 models are for the second set of derivatives.

1. AE1= $-1.8162 * \varepsilon HOMO + 0.00613229 * \Delta H_f^0 - 0.000785116 * T_E - 13.7744$
rCV^2= 0.664006 r^2=0.840903

2.AB1= $-1.49488 * \varepsilon HOMO - 0.000542714 * T_E - 10.0515$
rCV^2 = 0.706734 r^2 = 0.796352

3. AC1= $-1.8705 * \varepsilon HOMO - 5.13931e-005 * E_E - 12.7958$
rCV^2=0.590677 r^2=0.799122

4. AD1= $-1.91022 * \varepsilon HOMO + 5.67417e-005 * CCR - 13.0869$
rCV^2=0.572873 r^2=0.798708

5. BD2= $0.460591 * \varepsilon LUMO + 9.38031e-005 * CCR + 2.83955$
rCV^2=0.593002 r^2=0.681423

6. BC2= $0.490815 * \varepsilon LUMO - 8.40854e-005 * E_E + 2.78986$
rCV^2=0.584575 r^2=0.676855

7. BB2= $0.823207 * \varepsilon LUMO - 0.000846102 * T_E + 2.27377$
rCV^2=0.537663 r^2=0.654147

8. CE3= $2.89544 * \eta + 0.00516749 * \Delta H_f^0 - 0.00107596 * T_E - 10.7875$
rCV^2=0.705576 r^2=0.745561

9. CB3= $2.49273 * \eta - 0.000833051 * T_E - 8.28286$
rCV^2=0.708277 r^2=0.723038

10. CC3= $1.66109 * \eta - 7.27207e-005 * E_E - 3.95975$
rCV^2=0.615362 r^2=0.674432

11. CD3= $1.54879 * \eta + 7.90238e-005 * CCR - 3.39941$
rCV^2=0.595555 r^2=0.665585

12. CF3= $2.54239 * \eta - 0.00091051 * E_E - 0.000918616 * CCR - 8.56613$
rCV^2=0.635477 r^2=0.723503

13. DE4= $-41.805 * S + 0.00669071 * \Delta H_f^0 - 0.00105687 * T_E + 11.4076$
rCV^2=0.695012 r^2=0.747656

14. DB4= $-32.4091 * S - 0.000726269 * T_E + 10.2811$
rCV^2=0.618474 r^2=0.699576

15. EF5= $-0.735139 * \mu + 0.00148396 * E_E + 0.00173565 * CCR + 0.536403$
rCV^2=0.715954 r^2=0.750992

16. EE5= $0.628027 * \mu + 0.00834673 * \Delta H_f^0 - 0.00117241 * T_E +$

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3.3483
rCV^2=0.588214 r^2=0.711502

17. ED5= 0.221149 * μ+8.71208e-005 * CCR+3.62985
rCV^2=0.631789 r^2=0.69208

18. EC5= 0.25829 * μ-7.78614e-005 * E_E+3.74594
rCV^2=0.621937 r^2=0.685713

19. EB5= 0.652167*μ-0.000763381* T_E+ 4.98044
rCV^2=0.56389 r^2=0.647981

20. FF6= 0.748407 * χ +0.00107403 * E_E+ 0.00127539 * CCR+ 0.293994
rCV^2=0.630069 r^2=0.738405

21. FD6= 0.0592403 * χ +8.34386e-005 * CCR+2.4856
rCV^2=0.568168 r^2=0.70639

22. FC6= 0.0207267* χ -7.47739e-005* E_E+2.60443
rCV^2=0.56048 r^2=0.701764

23. FB6= -0.382568 * χ-0.000745717 * T_E +3.85861
rCV^2=0.527949 r^2=0.674235

24. AF1= 0.691323 * HOMO-0.00016104 * E_E-0.000178107 * CCR+12.2965
rCV^2=0.592462 r^2=0.757615

25. AD1= 0.737285 * HOMO-8.63084e-007 * CCR+12.8817
rCV^2=0.60677 r^2=0.681296

26. AC1= 0.739754 * HOMO+6.8563e-007 * E_E+12.8999
rCV^2=0.609708 r^2=0.680598

27.AE1= 0.763974*HOMO-0.000202603* ΔH_f^0-3.0367e-006 * T_E+13.0718
rCV^2=0.62569 r^2=0.679943

28. AA1= 0.758008 * HOMO-0.000184647 * ΔH_f +13.0344
rCV^2=0.625298 r^2=0.679564

29. AB1= 0.759165 * C-2.01175e-006 * T_E+13.0299
rCV^2=0.625306 r^2=0.678498

30. BF2= 0.415762 * LUMO-0.000159386 * E_E-0.00017517 * CCR + 6.58703
rCV^2=0.510711 r^2=0.599393

31. FF6= -0.591896 * χ -0.000281873 * E_E-0.000308132 * CCR + 8.85048
rCV^2=0.575302 r^2=0.743846

The predicted activity of different combinations are presented in TABLE 7-12 for first set of derivatives and 13-18 for second set of derivatives.

TABLE 7: Containing predicted activity values with regression analysis by using εHOMO and different energy descriptors.

No.	log I/C	AA1	AB1	AC1	AD1	AE1	AF1
1	3.43	4.712	4.589	4.567	4.564	4.620	4.569
2	3.68	4.578	4.131	4.118	4.116	3.89	4.12
3	3.82	4.14	4.006	3.833	3.814	3.943	3.845
4	4	4.574	4.217	4.31	4.319	4.128	4.305
5	4.15	4.587	4.349	4.375	4.377	4.331	4.374
6	4.25	4.484	4.38	4.389	4.389	4.459	4.389
7	4.38	4.786	4.797	4.72	4.711	4.883	4.726
8	4.62	4.312	4.337	4.371	4.39	4.523	4.358
9	4.68	5.948	5.985	5.875	5.863	5.857	5.883
10	4.68	5.861	5.904	5.802	5.790	5.770	5.810
11	4.7	4.3	4.537	4.597	4.603	4.79	4.594
12	4.74	4.896	4.419	4.389	4.385	4.201	4.391
13	4.85	5.514	5.305	5.331	5.333	5.057	5.33
14	5.14	4.521	4.615	4.736	4.747	4.897	4.728
15	1.19	5.776	6.050	5.899	5.882	6.045	5.910
16	5.44	5.193	4.973	4.993	4.994	4.806	4.992
17	5.74	5.176	5.893	6.078	6.095	6.001	6.066
18	5.82	5.657	5.831	5.741	5.73	5.782	5.748
19	5.89	5.72	5.998	5.848	5.831	5.99	5.859
20	5.96	6.12	6.169	6.158	6.156	6.077	6.159
21	6.11	4.731	5.335	5.304	5.299	5.533	5.307

TABLE 8: Containing predicted activity values with regression analysis by using εLUMO and different energy descriptors

No.	log I/C	BA2	BB2	BC2	BD2	BE2	BF2
1	3.43	4.425	4.198	4.159	4.151	4.213	4.089
2	3.68	4.544	4.405	4.39	4.387	4.246	4.347
3	3.82	4.369	4.246	4.182	4.171	4.291	4.078
4	4	4.302	4.194	4.225	4.227	4.113	4.243
5	4.15	4.322	4.122	4.111	4.107	4.099	4.075
6	4.25	4.208	4.142	4.104	4.096	4.206	4.032
7	4.38	4.499	4.301	4.23	4.218	4.369	4.118
8	4.62	4.083	3.918	3.989	4.02	4.075	4.396
9	4.68	5.52	5.321	5.301	5.297	5.202	5.261
10	4.68	5.48	5.422	5.407	5.404	5.315	5.371
11	4.7	4.155	4.268	4.461	4.48	4.519	4.696
12	4.74	4.651	4.168	4.091	4.079	3.967	3.97
13	4.85	5.171	5.527	5.520	5.523	5.345	5.489
14	5.14	4.111	3.611	3.827	3.843	3.793	4.094
15	1.19	5.448	5.429	5.433	5.432	5.447	5.425
16	5.44	4.855	5.101	5.052	5.048	4.976	4.965
17	5.74	5.276	6.529	7.191	7.273	6.806	8.040
18	5.82	5.283	5.668	5.609	5.605	5.658	5.514
19	5.89	5.422	5.495	5.494	5.493	5.52	5.478
20	5.96	5.494	5.441	5.458	5.46	5.322	5.465
21	6.11	4.739	5.941	6.085	6.106	6.258	6.252

TABLE 9: Containing predicted activity values with regression analysis by using hardness (η) and different energy descriptors

No.	log I/C	CA3	CB3	CC3	CD3	CE3	CF3
1	3.43	4.33	4.182	4.189	4.193	4.21	4.186
2	3.68	4.561	4.259	4.351	4.361	4.152	4.25
3	3.82	4.333	3.769	3.908	3.931	3.756	3.765
4	4	4.235	4.273	4.362	4.37	4.281	4.263
5	4.15	4.231	4.138	4.192	4.2	4.16	4.135
6	4.25	4.086	4.162	4.187	4.192	4.264	4.162
7	4.38	4.401	4.24	4.199	4.201	4.287	4.25
8	4.62	3.911	3.844	4.000	4.044	3.993	3.559
9	4.68	5.6	5.283	5.098	5.081	5.107	5.303
10	4.68	5.57	5.37	5.195	5.177	5.217	5.387
11	4.7	4.001	4.092	4.334	4.361	4.302	4.072
12	4.74	4.636	4.155	4.148	4.151	3.999	4.159
13	4.85	5.289	5.629	5.491	5.468	5.529	5.633
14	5.14	3.879	3.620	3.869	3.902	3.762	3.604
15	1.19	5.505	5.261	5.110	5.098	5.173	5.279
16	5.44	4.903	5.213	5.095	5.077	5.172	5.217
17	5.74	5.408	6.072	6.508	6.539	6.242	6.017
18	5.82	5.361	5.671	5.443	5.416	5.652	5.689
19	5.89	5.486	5.318	5.166	5.153	5.245	5.335
20	5.96	5.56	5.619	5.396	5.37	5.494	5.637
21	6.11	4.769	5.652	5.698	5.696	5.928	5.64

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TABLE 10: Containing predicted activity values with regression analysis by using global softness (S) and energy descriptors

No.	log I/C	DA4	DB4	DC4	DD4	DE4	DF4
1[a]	3.43	4.498	4.351	4.338	4.337	4.369	4.364
2	3.68	4.66	4.4	4.471	4.476	4.247	4.436
3	3.82	4.55	4.003	4.098	4.111	3.956	4.063
4	4	4.376	4.383	4.46	4.465	4.376	4.417
5	4.15	4.398	4.295	4.33	4.333	4.307	4.322
6	4.25	4.284	4.317	4.326	4.326	4.433	4.335
7	4.38	4.577	4.411	4.354	4.35	4.455	4.412
8	4.62	4.173	4.06	4.174	4.207	4.229	3.974
9	4.68	5.57	5.322	5.153	5.137	5.088	5.274
10	4.68	5.535	5.399	5.24	5.224	5.199	5.351
11	4.7	4.264	4.283	4.475	4.494	4.534	4.364
12	4.74	4.728	4.318	4.296	4.294	4.099	4.328
13	4.85	5.221	5.577	5.470	5.454	5.457	5.531
14	5.14	4.173	3.872	4.063	4.084	4.025	3.963
15	5.19	5.530	5.289	5.156	5.143	5.161	5.257
16	5.44	4.91	5.208	5.114	5.101	5.157	5.173
17	5.74	5.432	6.006	6.402	6.436	6.232	6.12
18	5.82	5.333	5.657	5.457	5.434	5.643	5.587
19	5.89	5.507	5.343	5.208	5.195	5.238	5.308
20	5.96	5.496	5.613	5.416	5.394	5.46	5.546
21	6.11	4.867	5.642	5.685	5.685	6.009	5.648

TABLE 11: Containing predicted activity values with regression analysis by using chemical potential (μ) and energy descriptors

No.	log I/C	EA5	EB5	EC5	ED5	EE5	EF5
1	3.43	4.443	4.16	4.113	4.103	4.169	3.998
2	3.68	4.448	4.253	4.223	4.217	3.98	4.112
3	3.82	4.286	4.307	4.165	4.146	4.353	3.815
4	4	4.277	3.992	4.035	4.037	3.833	4.105
5	4.15	4.323	4.018	4.004	3.999	3.956	3.958
6	4.25	4.227	4.039	4.001	3.992	4.109	3.9
7	4.38	4.531	4.321	4.234	4.22	4.419	4.035
8	4.62	4.134	3.924	3.962	3.988	4.139	4.566
9	4.68	5.505	5.371	5.352	5.349	5.232	5.29
10	4.68	5.446	5.429	5.417	5.415	5.302	5.359
11	4.7	4.191	4.292	4.434	4.447	4.659	4.736
12	4.74	4.614	4.088	4.008	3.995	3.763	3.816
13	4.85	5.07	5.236	5.278	5.285	4.959	5.307
14	5.14	4.238	3.737	3.905	3.918	4.004	4.313
15	1.19	5.440	5.545	5.528	5.525	5.619	5.464
16	5.44	4.786	4.833	4.828	4.827	4.63	4.764
17	5.74	5.144	6.455	7.040	7.117	6.909	8.247
18	5.82	5.237	5.548	5.518	5.515	5.557	5.4
19	5.89	5.402	5.583	5.562	5.56	5.665	5.486
20	5.96	5.503	5.378	5.434	5.44	5.235	5.537
21	6.11	4.651	5.775	5.901	5.92	6.263	6.092

TABLE 12: Containing predicted activity values with regression analysis by using electronegativity (χ) and energy descriptors

No.	log I/C	FA6	FB6	FC6	FD6	FE6	FF6
1	3.43	4.467	4.256	4.222	4.215	4.275	4.152
2	3.68	4.442	4.263	4.239	4.235	4.137	4.172
3	3.82	4.271	4.342	4.212	4.196	4.381	3.969
4	4	4.256	4.022	4.074	4.078	3.96	4.142
5	4.15	4.32	4.083	4.082	4.078	4.069	4.064
6	4.25	4.214	4.106	4.081	4.075	4.161	4.023
7	4.38	4.575	4.44	4.368	4.356	4.502	4.233
8	4.62	4.119	4.019	4.071	4.098	4.151	4.531
9	4.68	5.697	5.549	5.529	5.526	5.464	5.476
10	4.68	5.622	5.582	5.567	5.565	5.503	5.517
11	4.7	4.184	4.384	4.53	4.544	4.588	4.76
12	4.74	4.65	4.161	4.096	4.085	4.008	3.97
13	4.85	5.156	5.271	5.304	5.309	5.124	5.322
14	5.14	4.261	3.906	4.091	4.106	4.066	4.405
15	1.19	5.628	5.731	5.710	5.707	5.753	5.654
16	5.44	4.835	4.867	4.861	4.86	4.766	4.818
17	5.74	5.254	6.504	7.041	7.108	6.716	7.898
18	5.82	5.373	5.656	5.619	5.615	5.648	5.524
19	5.89	5.58	5.753	5.728	5.725	5.78	5.661
20	5.96	5.694	5.554	5.605	5.61	5.466	5.672
21	6.11	4.686	5.796	5.899	5.915	6.039	6.028

TABLE 13: Containing predicted activity values by using εHOMO and different energy descriptors

Comp.	log I/C	AA1	AB1	AC1	AD1	AE1	AF1
22	6.17	6.514	6.51	6.527	6.529	6.509	6.507
23	6.17	6.559	6.558	6.56	6.561	6.558	6.554
24	6.2	6.364	6.364	6.352	6.35	6.368	6.331
25	6.21	6.384	6.378	6.396	6.398	6.379	6.411
26	6.24	6.35	6.361	6.346	6.344	6.353	6.291
27	6.33	6.392	6.403	6.388	6.386	6.395	6.33
28	6.37	6.424	6.413	6.404	6.403	6.43	6.503
29	6.37	6.333	6.333	6.335	6.335	6.332	6.306
30	6.43	6.379	6.367	6.376	6.377	6.377	6.363
31	6.45	6.311	6.305	6.325	6.327	6.306	6.349
32	6.46	6.478	6.479	6.473	6.471	6.479	6.377
33	6.52	6.529	6.531	6.528	6.528	6.53	6.497
34	6.52	6.582	6.587	6.602	6.603	6.576	6.602
35	6.54	6.598	6.607	6.614	6.614	6.594	6.59
36	6.55	6.491	6.503	6.486	6.485	6.496	6.545
37	6.58	6.585	6.583	6.593	6.594	6.582	6.607
38	6.6	6.503	6.505	6.507	6.507	6.503	6.57
39	6.63	6.605	6.601	6.611	6.611	6.602	6.588
40	6.66	6.596	6.586	6.592	6.592	6.595	6.585
41	6.68	6.586	6.584	6.587	6.587	6.585	6.581
42	6.72	6.828	6.821	6.82	6.82	6.828	6.796
43	6.72	6.4	6.391	6.386	6.386	6.403	6.482
44	6.77	6.874	6.871	6.871	6.871	6.874	6.823
45	6.77	6.554	6.559	6.555	6.555	6.555	6.61
46	6.82	6.674	6.678	6.663	6.662	6.68	6.766
47	6.85	6.351	6.345	6.353	6.354	6.348	6.324

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TABLE 14: Containing predicted activity values by using εLUMO and different energy descriptors

Comp.	log I/C	BA2	BB2	BC2	BD2	BE2	BF2
22	6.17	6.575	6.591	6.599	6.599	6.591	6.566
23	6.17	6.562	6.561	6.561	6.561	6.561	6.574
24	6.2	6.257	6.248	6.242	6.241	6.251	6.23
25	6.21	6.397	6.417	6.43	6.431	6.42	6.403
26	6.24	6.276	6.271	6.26	6.258	6.265	6.226
27	6.33	6.324	6.317	6.305	6.303	6.311	6.276
28	6.37	6.374	6.351	6.353	6.354	6.36	6.465
29	6.37	6.574	6.566	6.559	6.558	6.565	6.552
30	6.43	6.58	6.574	6.574	6.574	6.581	6.569
31	6.45	6.389	6.41	6.423	6.424	6.413	6.399
32	6.46	6.575	6.563	6.55	6.549	6.561	6.5
33	6.52	6.584	6.577	6.571	6.57	6.575	6.574
34	6.52	6.527	6.549	6.56	6.56	6.543	6.546
35	6.54	6.573	6.585	6.587	6.588	6.576	6.578
36	6.55	5.966	5.975	5.983	5.984	5.971	6.015
37	6.58	6.584	6.591	6.598	6.598	6.59	6.617
38	6.6	6.352	6.358	6.367	6.368	6.356	6.419
39	6.63	6.611	6.618	6.621	6.621	6.618	6.61
40	6.66	6.593	6.59	6.592	6.592	6.595	6.602
41	6.68	6.571	6.57	6.57	6.57	6.569	6.586
42	6.72	6.699	6.691	6.69	6.69	6.694	6.714
43	6.72	6.383	6.366	6.371	6.372	6.374	6.471
44	6.77	6.73	6.727	6.724	6.724	6.726	6.73
45	6.77	6.373	6.375	6.381	6.382	6.372	6.439
46	6.82	6.397	6.383	6.384	6.385	6.381	6.521
47	6.85	6.56	6.559	6.556	6.556	6.561	6.534

TABLE 15: Containing predicted activity values with regression analysis by using hardness (η) and different energy descriptors

Comp.	log I/C	CA3	CB3	CC3	CD3	CE3	CF3
22	6.17	6.507	6.512	6.539	6.542	6.372	6.442
23	6.17	6.522	6.524	6.524	6.524	6.525	6.559
24	6.2	6.676	6.544	6.519	6.516	6.866	6.446
25	6.21	6.618	6.517	6.548	6.551	6.54	6.458
26	6.24	6.405	6.545	6.511	6.507	6.441	6.38
27	6.33	6.377	6.544	6.509	6.505	6.403	6.396
28	6.37	6.881	6.543	6.517	6.516	7.269	6.883
29	6.37	6.444	6.526	6.5	6.498	6.509	6.586
30	6.43	6.692	6.521	6.512	6.512	6.853	6.584
31	6.45	6.606	6.516	6.545	6.548	6.536	6.494
32	6.46	6.473	6.531	6.501	6.497	6.56	6.377
33	6.52	6.459	6.527	6.512	6.51	6.484	6.544
34	6.52	6.342	6.514	6.549	6.552	6.065	6.46
35	6.54	6.243	6.52	6.532	6.533	5.994	6.475
36	6.55	6.591	6.554	6.561	6.561	6.58	6.448
37	6.58	6.485	6.518	6.535	6.537	6.396	6.585
38	6.6	6.544	6.532	6.542	6.543	6.524	6.648
39	6.63	6.534	6.517	6.533	6.534	6.469	6.482
40	6.66	6.682	6.521	6.528	6.529	6.766	6.55
41	6.68	6.522	6.524	6.525	6.525	6.521	6.563
42	6.72	6.625	6.522	6.529	6.529	6.666	6.533
43	6.72	6.799	6.539	6.52	6.52	7.098	6.857
44	6.77	6.521	6.519	6.53	6.531	6.465	6.461
45	6.77	6.495	6.535	6.538	6.539	6.469	6.649
46	6.82	6.593	6.544	6.53	6.53	6.715	6.865
47	6.85	6.548	6.521	6.511	6.51	6.609	6.53

TABLE 16: Containing predicted activity values with regression analysis by using global softness (S) and energy descriptors

Comp.	log I/C	DA4	DB4	DC4	DD4	DE4	DF4
22	6.17	6.51	6.556	6.592	6.595	6.499	6.507
23	6.17	6.524	6.542	6.546	6.547	6.523	6.556
24	6.2	6.663	6.551	6.517	6.513	6.671	6.449
25	6.21	6.605	6.568	6.608	6.612	6.595	6.539
26	6.24	6.436	6.544	6.495	6.49	6.443	6.381
27	6.33	6.411	6.54	6.491	6.485	6.419	6.389
28	6.37	6.826	6.535	6.516	6.516	6.841	6.775
29	6.37	6.458	6.517	6.49	6.488	6.464	6.516
30	6.43	6.663	6.528	6.524	6.524	6.666	6.546
31	6.45	6.594	6.563	6.602	6.605	6.585	6.559
32	6.46	6.482	6.522	6.485	6.48	6.489	6.362
33	6.52	6.471	6.531	6.514	6.513	6.474	6.513
34	6.52	6.376	6.567	6.611	6.615	6.362	6.541
35	6.54	6.293	6.551	6.567	6.568	6.284	6.512
36	6.55	6.648	6.616	6.627	6.627	6.644	6.509
37	6.58	6.493	6.55	6.577	6.579	6.486	6.602
38	6.6	6.551	6.564	6.583	6.585	6.549	6.659
39	6.63	6.532	6.55	6.572	6.574	6.526	6.52
40	6.66	6.655	6.545	6.557	6.559	6.654	6.559
41	6.68	6.523	6.543	6.548	6.548	6.522	6.561
42	6.72	6.609	6.547	6.559	6.56	6.607	6.548
43	6.72	6.756	6.537	6.527	6.527	6.767	6.765
44	6.77	6.522	6.549	6.564	6.565	6.517	6.498
45	6.77	6.512	6.561	6.571	6.572	6.51	6.65
46	6.82	6.596	6.554	6.546	6.547	6.602	6.788
47	6.85	6.543	6.529	6.52	6.519	6.545	6.503

TABLE 17: Containing predicted activity values with regression analysis by using chemical potential (μ) and energy descriptors

Comp.	log I/C	EA5	EB5	EC5	ED5	EE5	EF5
22	6.17	6.519	6.53	6.539	6.54	6.53	6.507
23	6.17	6.525	6.525	6.525	6.525	6.525	6.533
24	6.2	6.253	6.246	6.239	6.239	6.248	6.234
25	6.21	6.354	6.367	6.381	6.382	6.369	6.362
26	6.24	6.264	6.261	6.249	6.248	6.256	6.221
27	6.33	6.311	6.306	6.294	6.292	6.301	6.269
28	6.37	6.35	6.333	6.332	6.333	6.34	6.437
29	6.37	6.455	6.454	6.449	6.449	6.453	6.429
30	6.43	6.473	6.471	6.473	6.473	6.476	6.457
31	6.45	6.324	6.338	6.353	6.354	6.34	6.334
32	6.46	6.506	6.5	6.489	6.487	6.499	6.432
33	6.52	6.53	6.527	6.521	6.52	6.526	6.517
34	6.52	6.512	6.527	6.537	6.538	6.522	6.528
35	6.54	6.549	6.558	6.56	6.56	6.552	6.55
36	6.55	6.105	6.106	6.107	6.108	6.101	6.168
37	6.58	6.549	6.554	6.56	6.561	6.553	6.576
38	6.6	6.366	6.368	6.375	6.376	6.367	6.432
39	6.63	6.574	6.578	6.582	6.582	6.579	6.568
40	6.66	6.557	6.554	6.556	6.556	6.558	6.562
41	6.68	6.541	6.54	6.539	6.539	6.54	6.551
42	6.72	6.709	6.702	6.698	6.698	6.704	6.717
43	6.72	6.348	6.336	6.338	6.339	6.342	6.432
44	6.77	6.747	6.742	6.738	6.737	6.742	6.74
45	6.77	6.399	6.398	6.401	6.401	6.395	6.463
46	6.82	6.455	6.442	6.438	6.439	6.442	6.573
47	6.85	6.451	6.453	6.453	6.453	6.455	6.422

TABLE 18: Containing predicted activity values by using electronegativity (χ) and energy descriptors

Comp.	log I/C	FA6	FB6	FC6	FD6	FE6	FF6
22	6.17	6.551	6.536	6.564	6.566	6.539	6.501
23	6.17	6.557	6.559	6.558	6.558	6.558	6.569
24	6.2	6.31	6.309	6.295	6.293	6.315	6.262
25	6.21	6.406	6.376	6.413	6.417	6.39	6.366
26	6.24	6.275	6.327	6.307	6.304	6.283	6.23
27	6.33	6.316	6.373	6.349	6.346	6.326	6.281
28	6.37	6.444	6.4	6.381	6.38	6.453	6.564
29	6.37	6.488	6.495	6.489	6.488	6.49	6.441
30	6.43	6.547	6.5	6.507	6.508	6.543	6.471
31	6.45	6.377	6.346	6.386	6.39	6.361	6.338
32	6.46	6.535	6.55	6.53	6.528	6.542	6.414
33	6.52	6.554	6.569	6.557	6.556	6.558	6.544
34	6.52	6.509	6.536	6.562	6.564	6.499	6.543
35	6.54	6.53	6.582	6.589	6.589	6.528	6.568
36	6.55	6.126	6.173	6.168	6.168	6.129	6.253
37	6.58	6.574	6.575	6.587	6.588	6.57	6.617
38	6.6	6.396	6.409	6.415	6.416	6.395	6.511
39	6.63	6.607	6.597	6.608	6.609	6.602	6.582
40	6.66	6.616	6.582	6.586	6.586	6.614	6.595
41	6.68	6.571	6.574	6.572	6.572	6.572	6.591
42	6.72	6.748	6.735	6.722	6.721	6.753	6.765
43	6.72	6.43	6.395	6.385	6.385	6.435	6.546
44	6.77	6.766	6.771	6.76	6.759	6.771	6.771
45	6.77	6.417	6.445	6.442	6.442	6.42	6.547
46	6.82	6.484	6.511	6.483	6.481	6.498	6.728
47	6.85	6.5	6.482	6.489	6.49	6.496	6.422

CONCLUSION

The values of cross validation coefficient and correlation coefficient and the sum of both are presented in TABLE-19. The values of cross validation coefficient indicate that EF5, CB3, AB1 and CE3 combinations provide values above 0.70, whereas values of correlation coefficient show that AE1, AB1, AC1, AD1, EF5, DE4, CE3, FF6, CB3, CF3, EE5 have values higher than 0.70, and are close to 0.80. These values are indicative of high degree of reliability of regression model and quality of predictive power. The values of both the coefficients have been added. If the sum of the two coefficients are taken as measure of quality of regression and values above 1.30 are considered as providing better models the following sequence is demonstrated.

First set:

AE1 > AB1 > EF5 > CE3 > DE4 > CB3 > AC1 > AD1 > FF6 > CF3 > ED5 > DB4 > EC5

Second set:

AF1 > FF6 > AE1 > AB1 > AA1

TABLE 19: Cross validation coefficient, correlation coefficient and their sum

Descriptor Combination	Cross validation Coefficient	Correlation Coefficient	Sum of rCV^2 and r^2
AE1	0.6640	0.8400	1.5040
AB1	0.7060	0.7960	1.5020
AC1	0.5900	0.7990	1.3890
AD1	0.5720	0.7980	1.3700
BD2	0.5930	0.6814	1.2744
BC2	0.5845	0.6768	1.2613
BB2	0.5377	0.6541	1.1918
CE3	0.7055	0.7455	1.4510
CB3	0.7082	0.7230	1.4312
CC3	0.6153	0.6744	1.2897
CD3	0.5955	0.6655	1.2610
CF3	0.6354	0.7235	1.3589
DE4	0.6950	0.7476	1.4426
DB4	0.6184	0.6995	1.3179
EF5	0.7159	0.7509	1.4668
EE5	0.5882	0.7115	1.2997
ED5	0.6317	0.6920	1.3237
EC5	0.6219	0.6857	1.3076
EB5	0.5638	0.6479	1.2117
FF6	0.6300	0.7384	1.3684
FD6	0.5681	0.7063	1.2744
FC6	0.5604	0.7017	1.2621
FB6	0.5279	0.6742	1.2021
AF1	0.5924	0.7576	1.3500
AD1	0.6067	0.6812	1.2879
AC1	0.6097	0.6805	1.2902
AE1	0.6256	0.6799	1.3055
AA1	0.6252	0.6795	1.3047
AB1	0.6253	0.6784	1.3037
BF1	0.5107	0.5993	1.1100
FF6	0.5753	0.7438	1.3191

The highest value is demonstrated by AE1 (HOMO + Heat of formation), the next is AB1 (HOMO + Total energy). Other combinations which have higher values are EF5 (chemical potential + EE+CC), CE3(absolute hardness+ heat of formation), DE4(S + heat of formation) and CB3 (absolute hardness + total energy).

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