Theoretical study of properties of Indoline-2,3-dione-3-oxime usingChemicalize Software(Remove the word "study")

Theoretical analysis of properties of Indoline-2,3-dione-3-oxime using Chemicalize Software(Suggested)

OR

Theoretical investigation of properties of Indoline-2,3-dione-3-oxime using Chemicalize Software(Suggested)

Abstract:

Indoline-2,3-dione-3-oxime (IDOX) (Isatin -3-oxime) is employed as an anticonvulsant and is known for treating various disorders caused by release of amino acids responsible for anxiety and excitatory behavior. In view of the biological importance of IDOX Properties, pka, Isoelectric Point, logP, logD, Solubility, Geometry, HNMR were determined by using Chemicalize software. **(add more 2-3 lines)**

Keywords: Indoline-2,3-dione-3-oxime, Isoelectric Point, Solubility, Geometry, HNMR**(4-6 keywords only)**

1. Introduction

In disorders such as cerebral ischemia or cerebral infarction leading to bad effects like hemorrhagic stroke, cardiac arrest and hypoglycemia excitatory amino acids cause to the degeneration of neurons. Compounds like Indoline-2,3-dione-3-oxime (Isatin-3-oxime)[1-4] possess property of blocking excitatory amino acid receptors which have therapeutic use over the effects of above breakdown [29].

From the Literature studies it is evident anticonvulsant screening of Indoline-2,3-dione-3-oxime (IDOX) was carried out by applying Maximal Electroshock (MES) model and the results indicated that IDOX is active at lower dose of 100 $mgkg^{-1}$. It is also found that IDOX is more potent when compared to standard drug sodium valproate [31].

With the application of chemicalize softwarethe structure of Indoline-2,3-dione-3- oxime (IDOX) is drawn and results obtained were interpreted in this present paper. Basic properties, structural properties, names and identifiersof IDOX were given in this present

paper.The details of pKa,isoelectric point, logP. logD, Solubility, Geometry and [1]HNMR spectrumof IDOX were also studied in this manuscript [30].

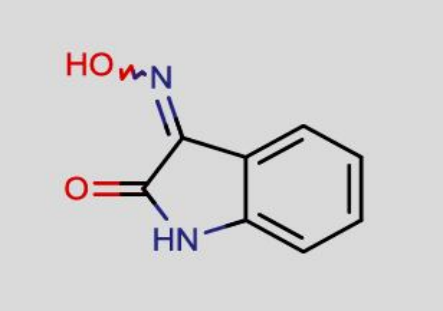


Fig.1 structure of Indoline-2,3-dione-3-oxime (IDOX)

2. Hypothetical Study of Indoline-2,3-dione-3-oxime using Chemicalize Software

Basic properties of Indoline-2,3-dione-3-oxime (IDOX)

Indoline-2,3-dione-3-oxime (IDOX) is drawn as the input of Chemicalize Software [5,6]and from the data obtained (Table.1)it is evident that the formula of Indoline-2,3-dione-3-oxime is $C_8H_6N_2O_2$. The data obtained also indicated that composition of Indoline-2,3-dione-3-oxime (IDOX) is C=59.26%, H=3.73%, N=17.28%, S (19.73%).

Table 1. properties of Indoline-2,3-dione-3-oxime (IDOX) as determined by chemicalize software

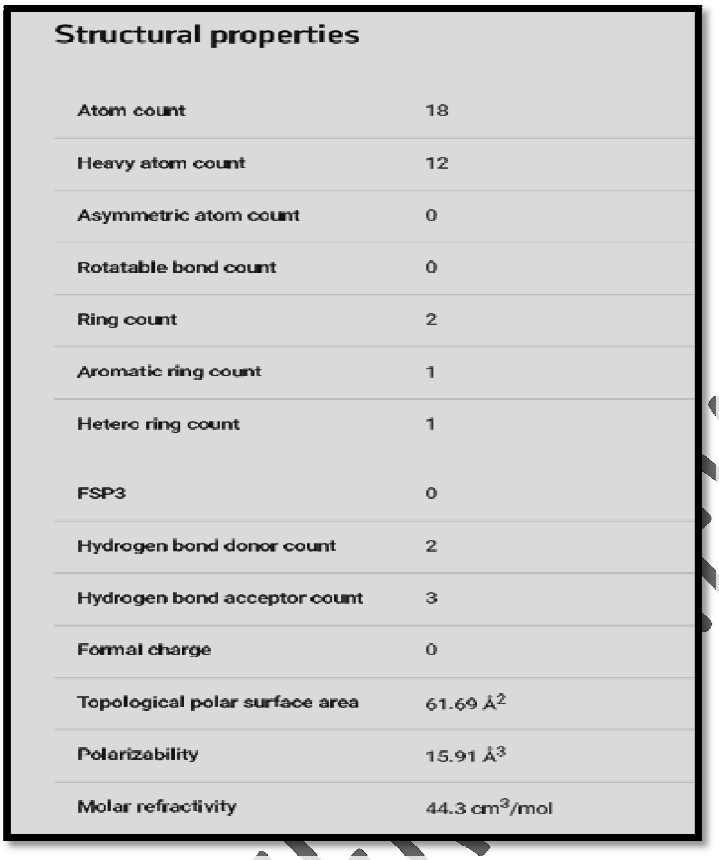
Input	Indoline-2,3-dione-3-oxime
Use major tautomer	✓ (the input is the major tautomer)
Molar mass	162.148 g/mol
Exact mass	162.042927441 Da
Formula	$C_8H_6N_2O_2$
Composition	C (59.26%), H (3.73%), N (17.28%), O (19.73%)
Lipinski's rule of five	✓

3. Structural Properties of Indoline-2,3-dione-3-oxime (IDOX)

Structural calculations of Indoline-2,3-dione-3-oxime (IDOX) as indicated by Chemicalize software(Table.2) enabled the evaluation of various topology-related characteristics, hydrogen bonding, and other physical properties. Table.4 shows the Data of structural properties of Indoline-2,3-dione-3-oxime (IDOX).

Chemical formula of IDOX is $C_8H_6N_2O_2$ and this in agreement with theatom count of 18 and this confirms the Chemical formula. The total heavy atom counts of 12 which indicates the presence of 8 carbons, 2 nitrogens and 2 oxygens in IDOX (fig 1&2). There is no asymmetric atom in IDOX and has no rotatable bonds[7-8.]Chemicalize data of IDOX indicates the presence of two rings where one is aromatic ring and other one is hetero ring. H bond donor count is 2 and H bond acceptor count is 3 in IDOX. The topological polar surface area[10,11]ofIndoline-2,3-dione-3-oxime is 61.69 $Å^2$, polarizability is 15.91 $Å^3$and its Molar refractivity is indicated to be 44.3 cm^3 /mol

Table 2. Structural properties of Indoline-2,3-dione-3-oxime as determined by Chemicalize



Structural properties

Atom count	18
Heavy atom count	12
Asymmetric atom count	0
Rotatable bond count	0
Ring count	2
Aromatic ring count	1
Hetero ring count	1
FSP3	0
Hydrogen bond donor count	2
Hydrogen bond acceptor count	3
Formal charge	0
Topological polar surface area	61.69 $Å^2$
Polarizability	15.91 $Å^3$
Molar refractivity	44.3 cm^3/mol

4. Names and Identifiers of Indoline-2,3-dione-3-oxime (IDOX)

IUPAC name of IDOX is 3-(hydroxyimino)-2,3-dihydro-1H-indol-2-one and it's the commonly used trivial or traditional name is isatin-3-oxime. other details like SMILES, InChI and InChIKey of IDOX as given by the chemicalize software are given in Table 3.

Table 3. Names and identifiers of Indoline-2,3-dione-3-oxime as given by chemicalize software

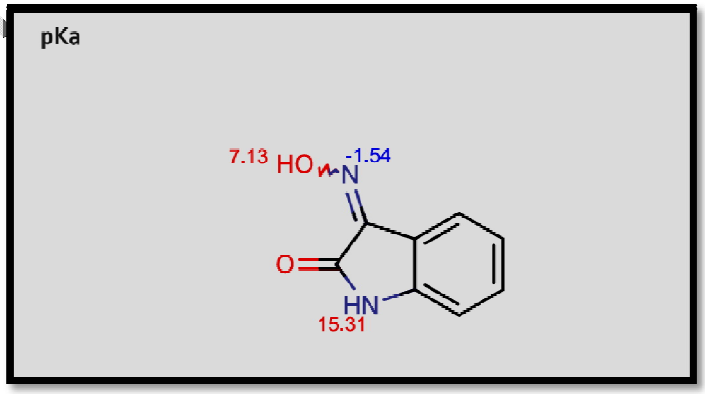
Names and identifiers

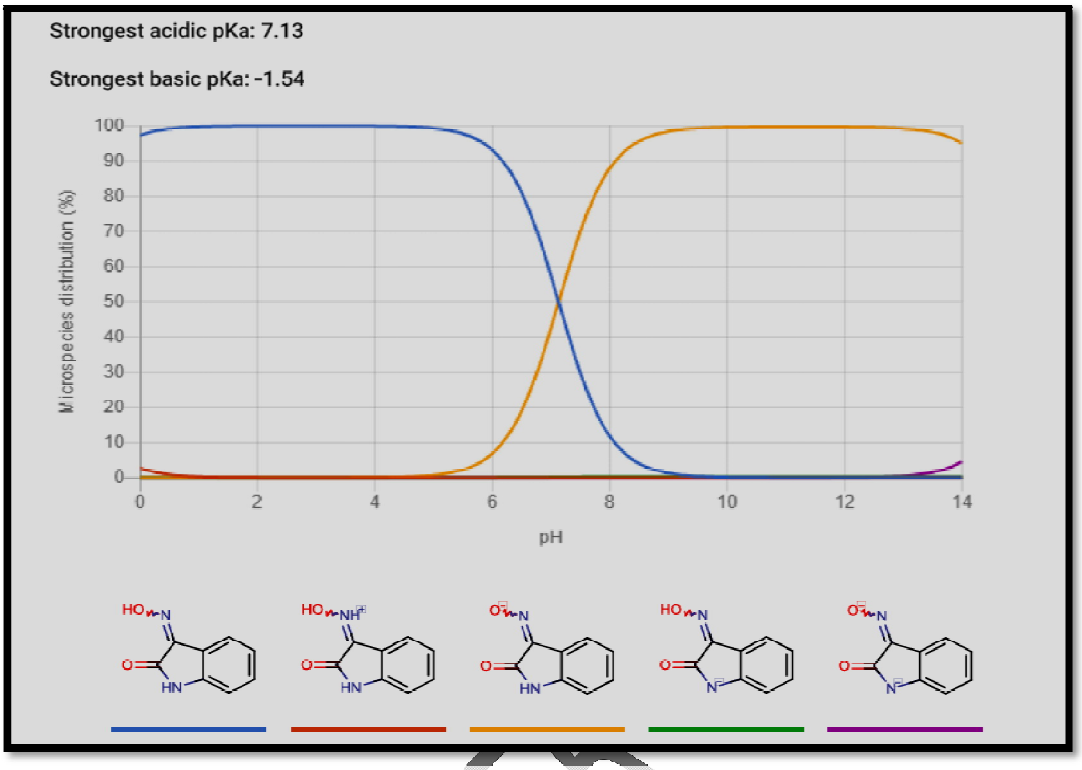
IUPAC name	3-(hydroxyimino)-2,3-dihydro-1H-indol-2-one
Traditional name	isatin-3-oxime
Common names	N/A
SMILES	ON=C1C(=O)NC2=CC=CC=C12
InChI	InChI=1S/C8H6N2O2/c11-8-7(10-12)5-3-1-2-4-6(5)9-8/h1-4,12H,(H,9,10,11)
InChIKey	LNMAXZZQNSPQSR-UHFFFAOYSA-N

5. pKa of Indoline-2,3-dione-3-oxime

pKa values of IDOXare found to be7.13 and 15.31as indicatedby Chemicalize data[12-16](fig.2). pKa value of 7.13 corresponds to dissociation of H of =N-OH group of IDOX and this indicates neutral nature of this group. pKa value of 15.31 corresponds to dissociation ofimino H atom of–NH-CO group. This attributes to the strong basic nature of Indoline-2,3-dione-3-oxime (IDOX).

Fig.2 Distribution of pH for the different microspecies of Indoline-2,3-dione-3-oxime as given by chemicalize software

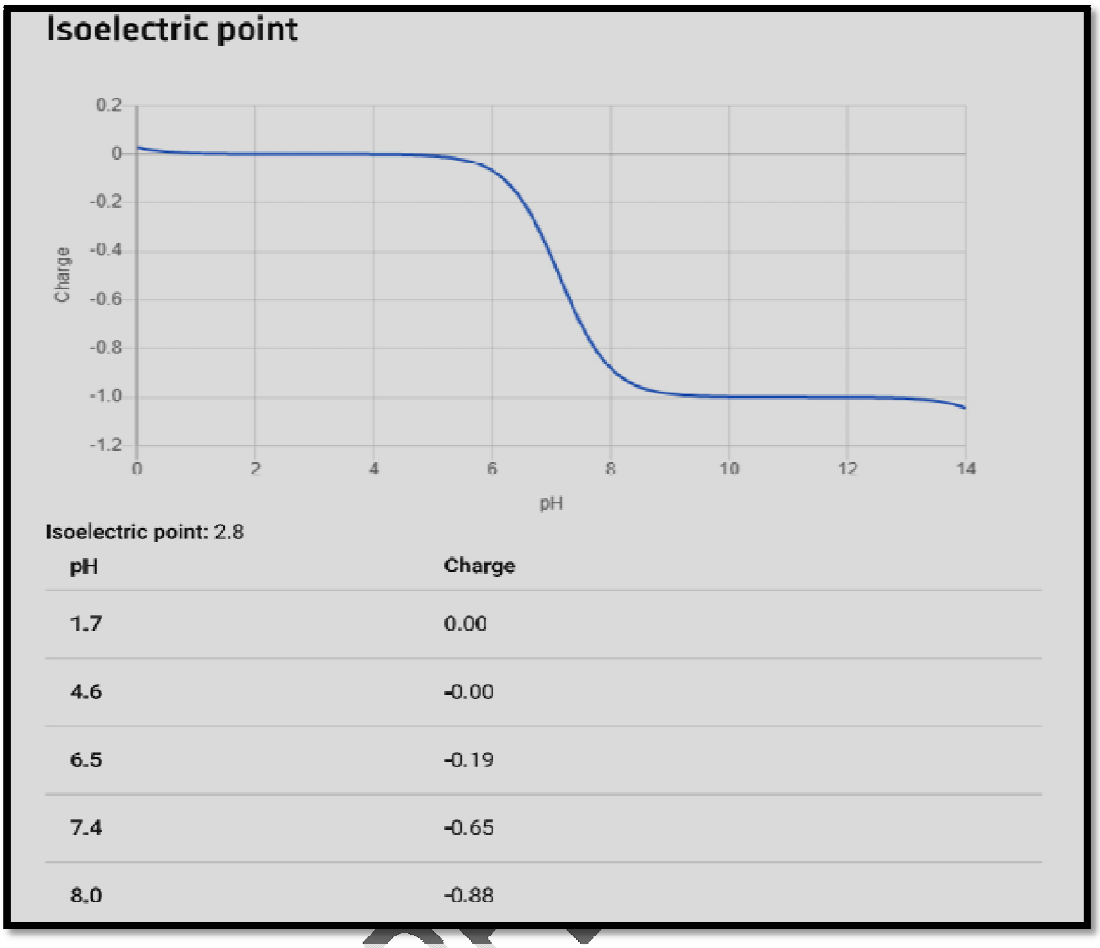




6. Isoelectric Point of Indoline-2,3-dione-3-oxime

Distribution of charge with pH of Indoline-2,3-dione-3-oxime as derived using chemicalize software is given in figure 3. The data of distribution of charge with pH of IDOX indicates that its isoelectric point is 2.8. IDOX is electrically neutral with zero electric charge within the pH range of 1.7 to 4.6 thereby indicating the isoelectric point[17,18] of 2.8.

Fig.3 Distribution of charge with pH of Indoline-2,3-dione-3-oxime as given by chemicalize software



Isoelectric point: 2.8

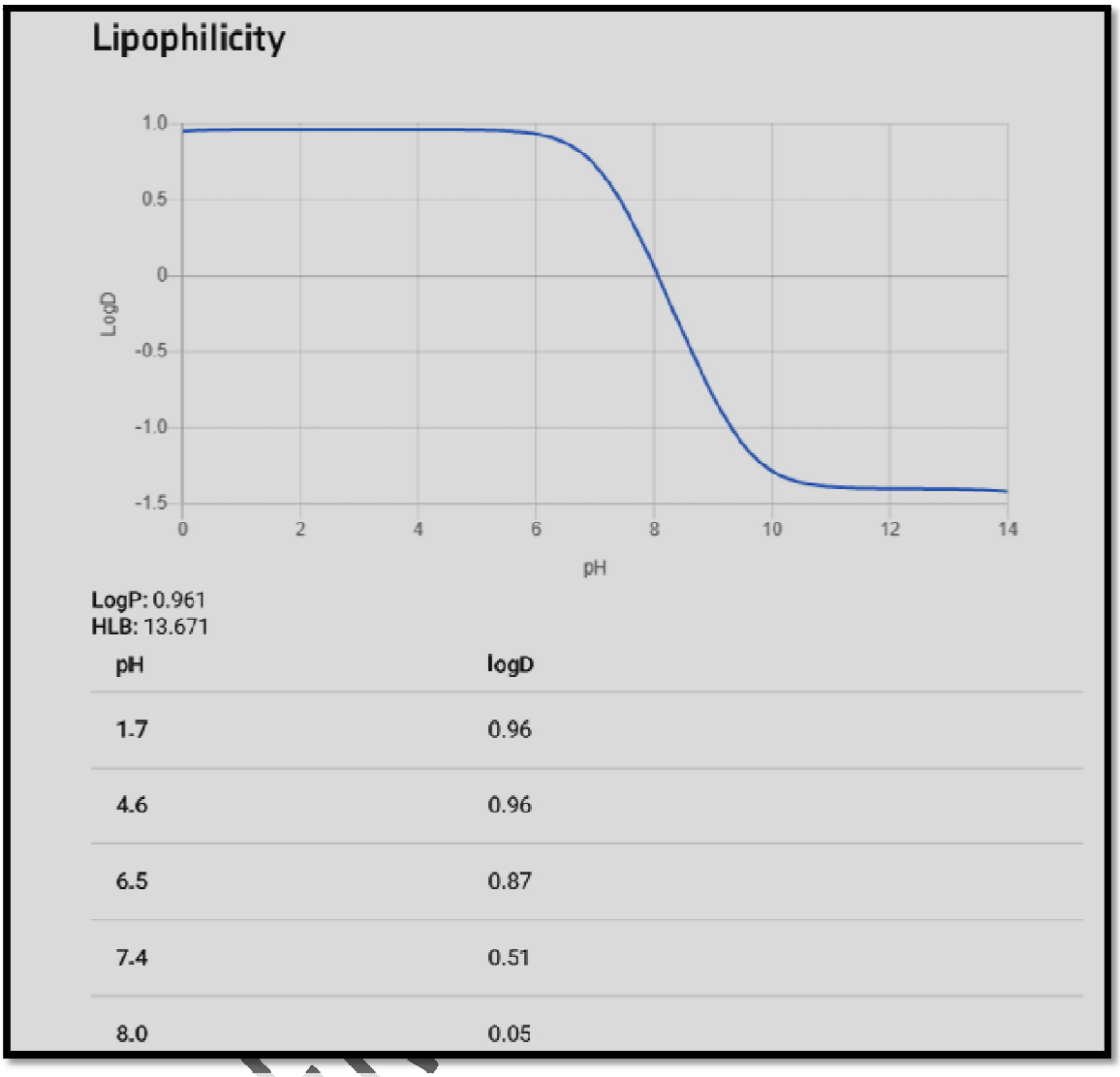
pH	Charge
1.7	0.00
4.6	-0.00
6.5	-0.19
7.4	-0.65
8.0	-0.88

7. log P and log D of Indoline-2,3-dione-3-oxime

logP value of Indoline-2,3-dione-3-oxime[19-21] is found to be 0.961.

Variation of the log D value of IDOX with pH is given in figure 4. log D value of IDOX is 0.96 within the pH range of 1.7 to 4.6 and further as the pH increases log D value decreases which is found to be 0.05 at pH 8 (Fig 4).

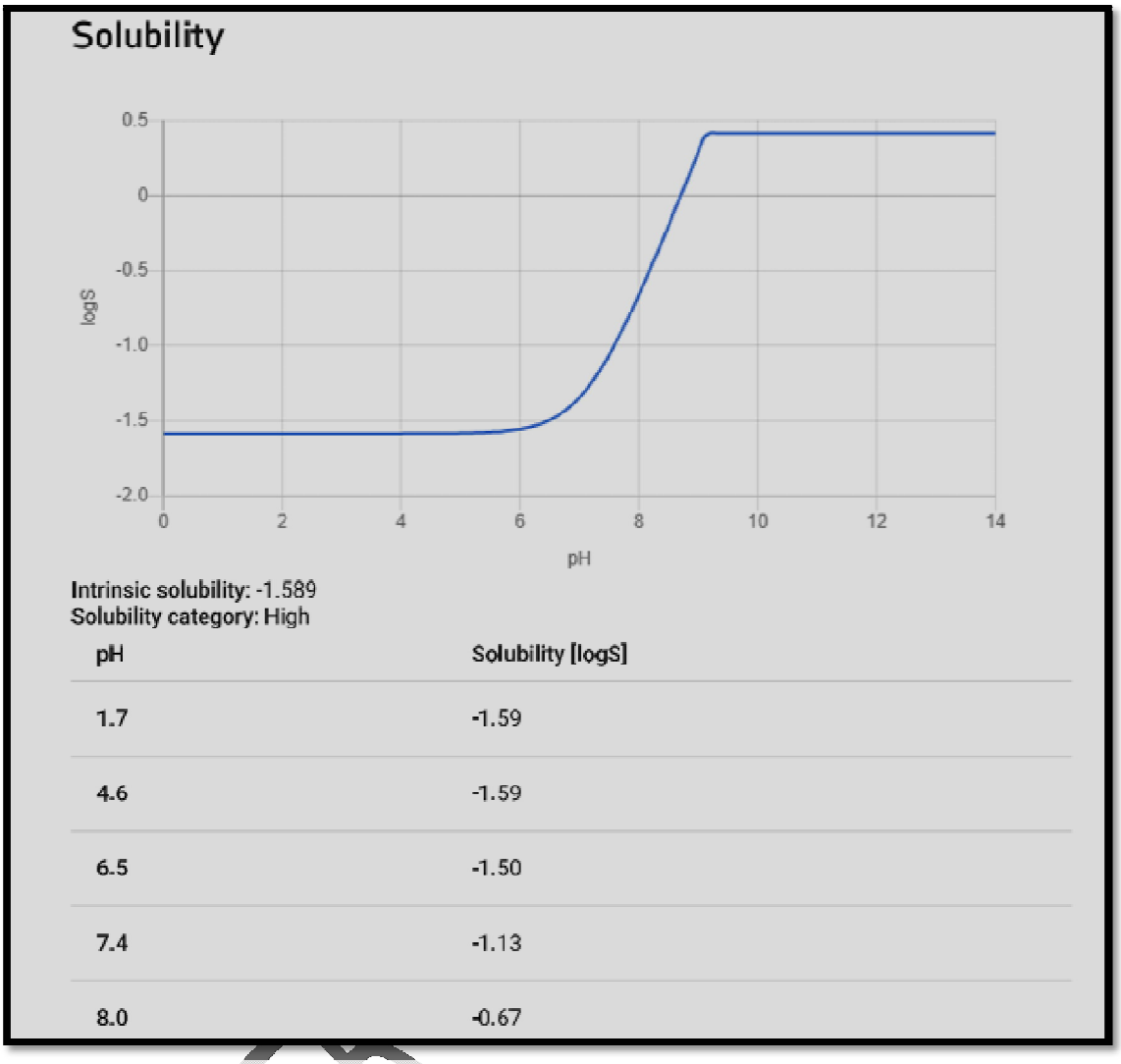
Fig.4 Distribution of log D with pH of Indoline-2,3-dione-3-oxime as given by chemicalize software



8. Solubility (log S) of Indoline-2,3-dione-3-oxime (IDOX)

Distribution of log S with pH ofIDOX as obtained by using Chemicalize software is given in Figure.5 and the data indicates that Indoline-2,3-dione-3-oxime[22-25] is of High solubility category with Intrinsic solubility of -1.589.

Fig.5 Distribution of log S with pH of Indoline-2,3-dione-3-oxime as given by chemicalize software



Intrinsic solubility: -1.589
Solubility category: High

pH	Solubility [logS]
1.7	-1.59
4.6	-1.59
6.5	-1.50
7.4	-1.13
8.0	-0.67

9. Geometry of Indoline-2,3-dione-3-oxime (IDOX)

Various geometrical parameters like Vander Waals volume, Vander Waals surface area, solvent accessible surface area,topological polar surface area, minimum and maximum projection area, minimum and maximum projection radius of Indoline-2,3-dione-3-oxime (IDOX) were measured with the application of chemicalize software[26](Table. 4).

Table. 4 Data of volume, surface area, projection area and projection radius of Indoline-2,3-dione-3-oxime as given by chemicalize software

Geometry

Van der Waals volume	130.9 $Å^3$
Van der Waals surface area	197.92 $Å^2$
Solvent accessible surface area	294.58 $Å^2$
Topological polar surface area	61.69 $Å^2$
Minimum projection area	25.15 $Å^2$
Maximum projection area	54.07 $Å^2$
Minimum projection radius	3.9 Å
Maximum projection radius	5.15 Å

10. H-NMR Spectrum of Indoline-2,3-dione-3-oxime (IDOX)

NMR Predictor of Chemicalize software is employed for recording NMR spectra of Indoline-2,3-dione-3-oxime (IDOX). The estimation of chemical shifts[27,28] of IDOX is in relation to the chemical shift of tetra methyl silane (TMS = 0ppm). H NMR spectrum of IDOX is given in the Table 5.

H-NMR

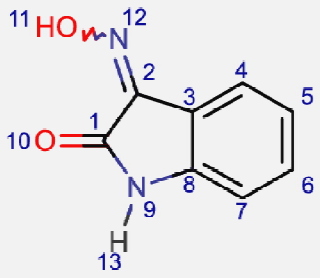
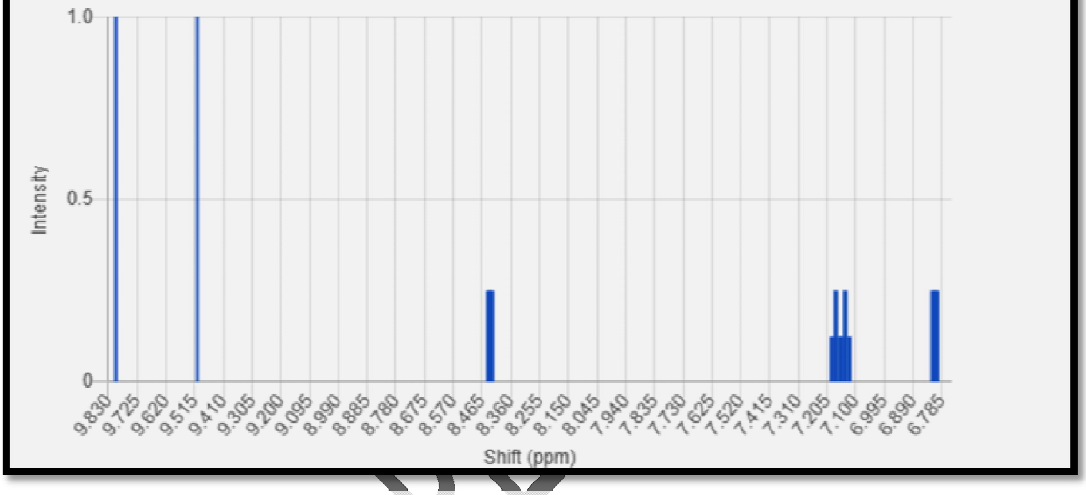


Table 5. shifts caused by the protons of Indoline-2,3-dione-3-oxime (IDOX) and the intensity and quality for each shift and corresponding protons as given by chemicalize software

Atoms	Shift	Intensity	Multiplet	Quality
7	6.771 ppm	1	q	medium
5	7.110 ppm	1	sx	good
6	7.156 ppm	1	sx	good
4	8.430 ppm	1	q	medium
13	9.511 ppm	1	s	rough
11	9.821 ppm	1	s	rough



The shifts caused by the protons of Indoline-2,3-dione-3-oxime (IDOX) is given in Table 5. The intensity and quality for each shift of IDOX is also obtained from this data.1H NMR spectrum of IDOX shows peaks at δ 9.82ppm (1H, =N-OH) and δ 6.77 ,7.11, 7.159(4H, Ar-H). The shift observed at 8.43 ppm also corresponds to protons of aromatic ring (Table.5).

Discussion (If it is required/Not necessarily)

Conclusions

The present article reflects the application of Chemicalize software in understanding various structural and physicochemical aspects of Indoline-2,3-dione-3-oxime (IDOX). Data of chemicalize software from pKa values and 1HNMR spectral data indicated that IDOX is of strong basic nature. Variation of properties like log D, log S, solubility in mg/L with pH of Indoline-2,3-dione-3-oxime (IDOX) is studied by Graphical interpretation by employing Chemicalize software. Apart from this the data of properties like Vander Waals area,Vander

Waals volume, projection area projection radius of IDOX is also obtained by applying chemicalize software.

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Author Contribution (Not necessarily)

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