



Initial study of the effect of substrates on Tetrahydrozoline and its nano-constituent drugs

Mohammad Amin Gholipour

Department of Medicinal Chemistry, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran.

*Corresponding Author e-mail Address: gholipour1985@gmail.com

Received 1 January 2016; Accepted 22 February 2016; Published 1 April 2016

Abstract

In this paper, the effect of halogen compounds on tetrahydrozoline with nanosized fullerene was investigated. First, the structures of Tetrahydrozoline on a fully vectorized nanoclay were optimized with halogen compounds on carbon 69 (R-X: X = F, Cl, Br; R = C60-Tetrahydrozoline-C69-). Then orbital calculations were performed using NBO technique, and structural parameters and bipolar moments of compounds were also analyzed. The results showed that the energy levels of the molecular orbitals (LUMO and HOMO) in the R-F have the lowest values, and C69-F are the shortest bond and the strongest among the C69-X bonds. Comparison of bipolar moments of compounds shows that the more the halogen is heavier, the lower the dipole moment of the compound. All computations were performed using the Hartree-Fock method and the base series 6-31G * in the Gaussian 2003 software and in the gas phase.

Keywords: Tetrahydrozoline, Fullerene, Dipole Moment, LUMO and HOMO.

1. Introduction

Tetrahydrozoline is a drug that causes vascular contraction and is produced from imidazoline. Figure 1-1 shows the structure of this drug.

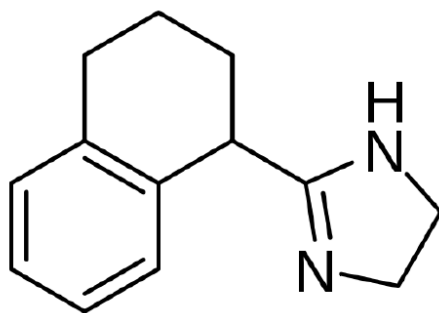
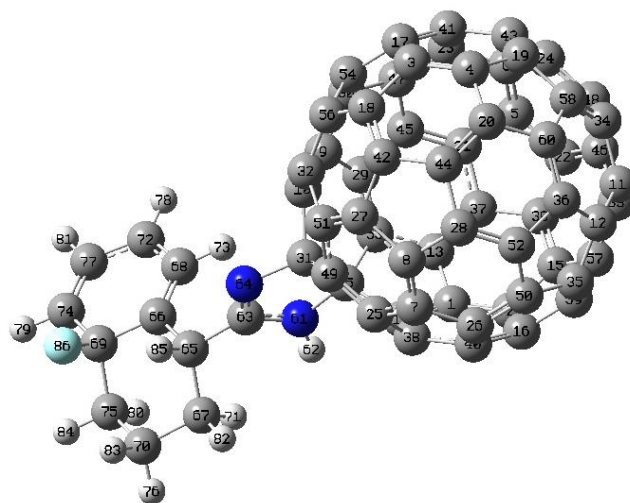


Fig 1. The Tetrahydrozoline structure

This drug is in the category of adrenergic drugs. Adrenergic drugs are used in the treatment of various diseases. For example, Tetrahydrozoline is one that is used locally for nasal congestion. The Tetrahydrozoline properties are similar to other imidazolines such as pegazolin, oximetazoline, and xylometazolin.

Nanotechnology is now widely used as a research tool in biomedical field for drug transport. The fullerene family, especially the derivatives of the C₆₀, exhibits photochemical, electrochemical and physical properties for biomedical applications. Therefore, in this work, fullerene was used as a nano-terminated Tetrahydrozoline drug. Figure 1-2 illustrates how to attach fullerene to tetrahydrozolin with a halogen component on carbon 69[1-10].

Fig 2. The structure of the C₆₀-Tetrahydrozoline-C₆₉-X

2. Computational details

. First, four combinations of R (Tetrahydrozoline-C₆₉) -X (tetrahydrozoline with halogen substituent), as well as these combinations with fullerene carriers, namely four R (C₆₀-Tetrahydrozoline-C₆₉) -X, X = H, F, Cl, Br were constructed using Gauss View software and then optimized at the HF / 6-31G * level in the gas phase by means of the Gaussian 03 software. The natural bonding orbital analysis (NBO) for non-nanocomposite compounds was also

performed at HF / 6-31G * level. Finally, the bipolar moments, structural parameters and energy levels of molecular orbitals were obtained for these compounds using these calculations and analyzed [11-13].

3. Results

Analyzing data on molecular orbital energy levels in non-nanocomposite compounds, according to Table 3-1 and Figure 1, shows that GAP energy in RF is higher than other halogens The highest value. Comparison of structural parameters in non-nanocomposite compounds (Table 2-2 and Fig. 3.2) shows that the length of the C69-F bond in R-F is shorter than other halogen derivatives.

Table1. LUMO and HOMO energies in R-X compounds

	Energy levels		
	HOMO	LUMO	Gap
R-H	-0.345	-0.153	0.192
R-F	-0.346	-0.177	0.169
R-Cl	-0.346	-0.180	0.166
R-Br	-0.34	-0.179	0.166

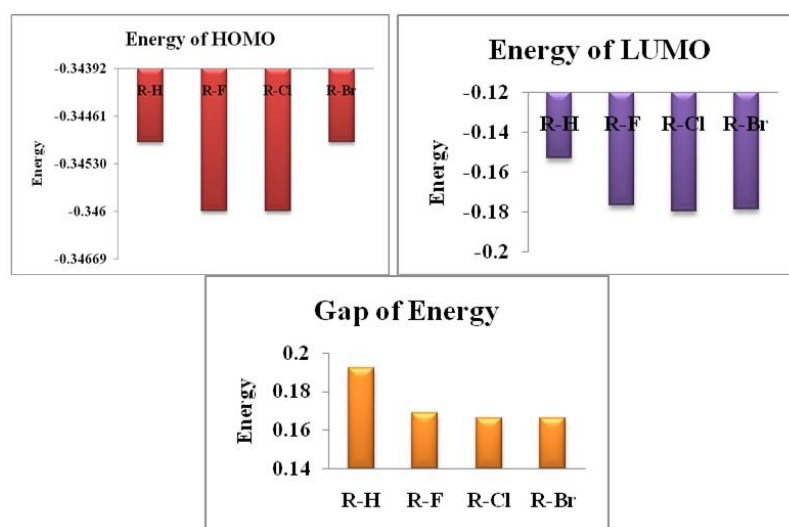


Fig 3. Changes in HOMO and LUMO energies in R-X with substitution change

Table 2. Structural Parameters in R-X Nanomaterials

	bonds	Angles		
	C69-X86	C74-C69-X86	C75-C69-X86	C66-C69-X86
R-H	1.092	107.9138	105.3870	107.9837
R-F	1.4114	108.2748	106.5741	109.3065
R-Cl	1.8887	103.7004	108.9964	107.2061
R-Br	2.0215	101.6689	108.4196	104.5313

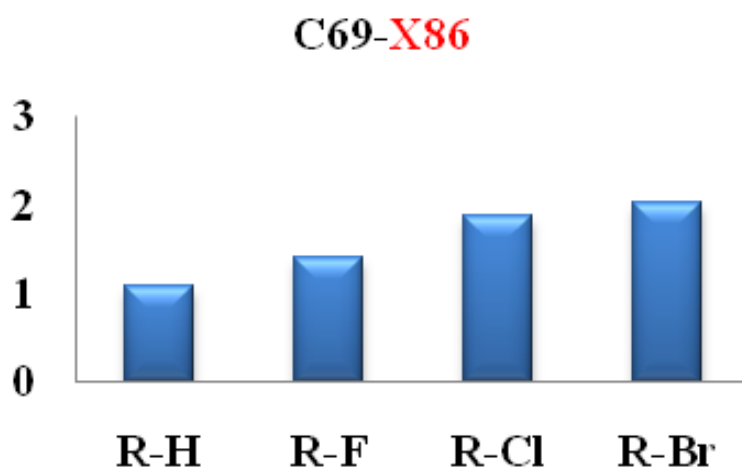


Fig 4. Change the length of the C69-X bond in the R-X by changing the substitution

The results of the analysis of bipolar moments in nanotube Tetrahydrozoline formulations, as well as non-nanocomposite compounds of fullerene and the effect of different substrates on them, are presented in Table 3-3 and Figure 3-3.

Table 3-3: Bipolar moments of R-X nanocomposite compounds without interconnected nanoclay

	Dipole moment(Debye)	
	C60-TETRAHYDROZOLINE	ONLY-TETRAHYDROZOLINE
R-H	32.5555	6.9693
R-F	31.1335	7.8624
R-Cl	30.5429	7.7492
R-Br	29.8146	7.6550

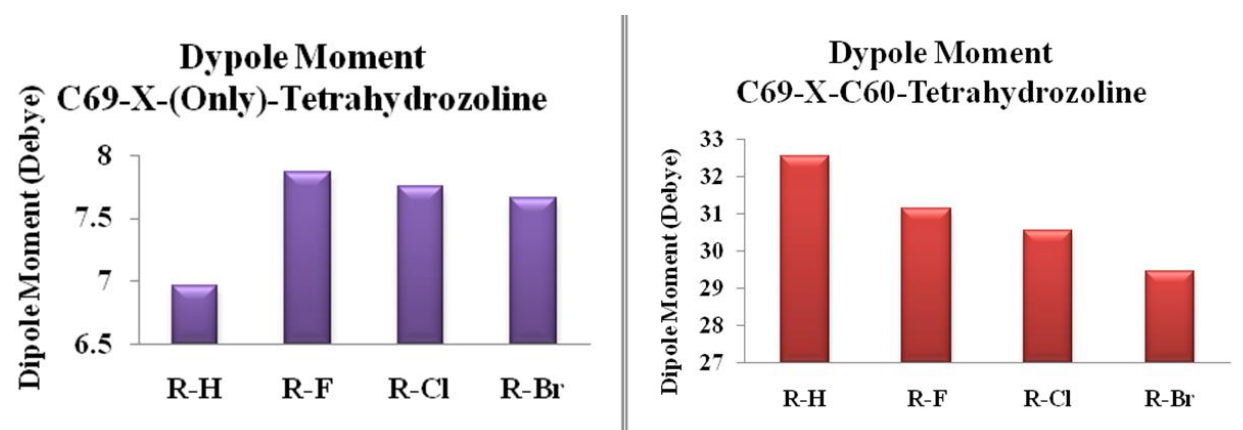


Fig 5. A dipole moment change with a sub solute in non-nanocomposite and non-nanocomposite compounds

As can be seen, bipolar moments show a decreasing trend with a heavier amount of halogen substituents.

4. Conclusion:

The resulting tables and diagrams show that because the energy Gap in the R-F composition is higher than other compounds, the electron transfer from HOMO to LUMO is more difficult and less reactive. Also, the shorter length of the C69-F bond in the R-X compound indicates that the C69-F bond is stronger than other C69-X bindings. Generally, according to Fig. 3.2, the strength of bond strength in the compounds follows the R-X process: R-F > R-Cl > R-Br. Also, the dipole moments change graphs show that for the bipolar momentum we have: R-F > R-Cl > R-Br.

Acknowledgment

We are appreciating and thanking Islamic Azad University of Yeager-e-Imam Khomeini (Rah) Share Rey.

Reference

- [1] G.M. Ziarani, A. Badiiei, A. Abbasi, Z.Farahani, *Chin. J. Chem.*, 27, 1537 (2009).
- [2] L.T. An, J.P. Zou, L.L. Zhang, *Catal.Comm.*, 9, 349 (2008).
- [3] K. Manabe, Y. Mori, S. Kobayashi, *Tetrahedron*, 57, 2537 (2001).
- [4] M. Shiri, M.A. Zolfigol, *Tetrahedron*, 65,587 (2009).
- [5] M.A. Bigdeli, G. Gholami, E.Sheikhhosseini, *Chin. Chem. Lett.*, 22, 903 (2011).
- [6] Y. Han, Y. Chu, *J. Mol. Catal. A: Chem.*,237, 232 (2005).
- [7] A. Doering, *Comb. Chem. High Throughput Screening*, 1, 1 (1998).
- [8] A. Doering, I. Ugi, *Angew. Chem., Int. Ed.*,39, 3169 (2000).
- [9] L. Weber, *Drug Discovery Today*, 7, 143 (2002).
- [10] J. Zhu, H. Bienayme, Eds.; Wiley-VCH:Weinheim, Germany (2005).
- [11] P. Wipf, C.Kendall, *Chem. Eur. J.*, 8, 1779(2002).
- [12] G. Balme, E. Bossharth, N. Monteiro, *Eur. J.Org. Chem.*, 22, 4101 (2003).
- [13] A. Jacobi von Wangelin, H. Neumann, D.Gordes, S. Klaus, D. Strubing, *Chem. Eur. J.*,9, 4286 (2003).