Theoretical Modeling of UV, IR and RMN Spectra of Enatiomers and Tautomers of Penicillamine

Jonathan Mendes[1] (IC), Katia J. de Almeida[1] (PQ)

***jonathanmendess@live.com**

[1] *Universidade Federal de Lavras,CP 3037, Campus Universitário, Lavras, MG*

Keywords: *Spectral, DFT, Conformations.*

.

Abstract

B3LYP and MP2 calculations were used to evaluate the conformations and IR, UV, RMN spectra of isomers of penicillamine.

Introduction

Penicillamine (Pen) (**Figure 1**) is a pharmaceutical drug used in treatment of several diseases such as rheumatoid arthritis and Willson's disease, a rare genetic disorder of copper metabolism.[1,2] In the latter case, Pen is used as a chelating agent. However, only D-Pen show desired biological activity in these diseases. The use of spectroscopy techniques can be, therefore, quite useful for identifying and charactering the enantiomer and tautomer species of penicillamine.

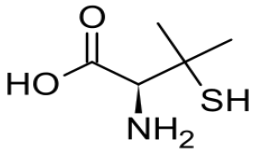

Figure 1. Molecular structure of penicillamine.

Despite of the Pen biological importance, very few experimental and theoretical investigations can be found in the literature.[3] In the present study, a detailed conformational analyses were carried out at B3LYP/CBSB7 level of theory in order to found out the most stable structures of the possible isomers of Pen. These calculations were performed in Gaussian program considering both gas-phase and aqueous solution (PCM) environment. UV, IR and RMN spectra of the most stable structures were computed in Orca program using DFT response theory.

Results e Discussion

The main results show that IR and RMN spectra cannot be used to identify D- and L- enantiomers of Pen, whereas clear differences can be observed in these spectra of Pen tautomers. The most striking results are shown in **figure 2**, where the UV spectral profiles of each Pen isomer is displayed. As can be seen, the absorption spectra show important differences relative to the number of bands, their intensities and maximum absorptions. These features can be safely used to identify and characterize each Pen isomers.

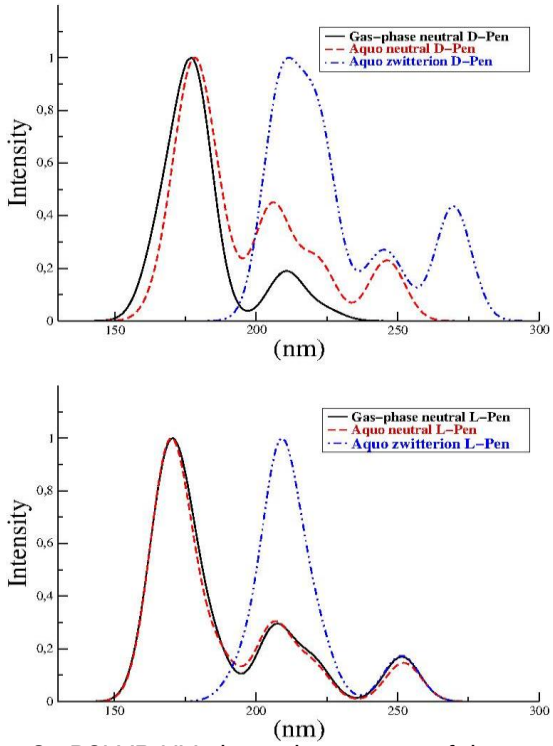

Figure 2. B3LYP UV absorption spectra of the most stable isomers of penicillamine.

Conclusion

The main results indicate that D-Pen structure is most stable than L-Pen (< 2 kcal mol^{-1}), while zwitterion form was only stable in the aquo solution, thus showing a good agreement with the previous experimental findings. The computed UV, IR and RMN spectra show interesting features, which can successfully used to identify the Pen isomers.

Acknowledgements

Fapemig, UFLA, DQI-UFLA.

[1] Peisach, J., Blumberg, W. E. *Molec. Phar.* **1969**, 5, 200-209.

[2] Camp, A. V. *Proc. Royal Soc. Med.* (1977), **70**, 67–69.

[3] Te, J., Hongwei, Z., Pengyu, H., Min, C., Tiqiao, X. *Nucl. Sci. Tech.* (2013), **24**, *010201-1—010201-5*