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Solvent Effect on the Structure and Electronic Transition Energy of Enrofloxacin

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INTRODUCTION

Antibiotics are natural or synthetic compounds able to inhibit growth or cause death of fungi or bacteria[1]. The enrofloxacin (ENR), a fluoroquilona broad spectrum derived from nalidixic acid, is used in the treatment of various infectious diseases but especially in the treatment of urinary tract, respiratory system and skin diseases, and is intended for dogs, cats and poultry. We studied the ENR isolated in water in order to assess structural changes and interactions with the environment that affect its energy transition.

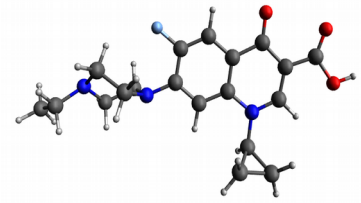

Figure 1 – Neutral 3D Enrofloxacin structure.

METHODS

The 3D structure of the neutral drug was optimized by Hartree-Fock method with basis 6-31G. The Molecular Dynamics (MD) was performed using the NAMD[2] software for 10ns with 1fs step, the temperature was 310K with NpT ensemble. Structural analyzes were made through the RMSD, RMSF and formation of hydrogen bonds. Finally the electronic transition energies were obtained using the computational package ORCA using ZINDO method. The experiments were made on Evolution 60-Thermo Scientific spectrophotometer at room temperature.

RESULTS AND DISCUSSION

In Figure 2, the RMSD graph (a) shows that the system has already been in equilibrium at the beginning of MD. By RMSF (b), we can observe the great mobility of atoms they do hydrogen bonds (HB), except O and N attached to aromatic ring, which have higher rigidity. This is important for evaluation of the interaction with the solvent, monitored by HB graph between water and drug, where we observe the presence of at least 1 HB during MD and may be made up to 7 connections, but with low probability. The graph (d) show the curves of optical absorption of the drug at acidic pH (3.4) where the molecule is in its neutral state and also the transition energy graph for all frames MD. We can see that the maximum absorbance are not next between the experimental and calculated, possibly because it does not take into account the participation of water in obtaining energy electronic transition.

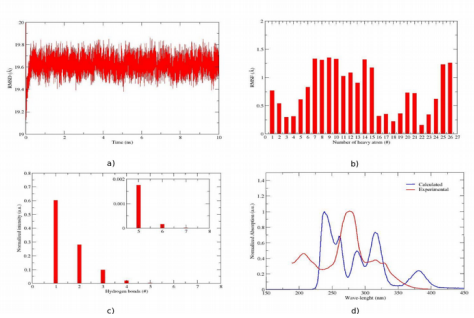

Figure 2 – RMSD(a), RMSF(b), HB(c) and Electronic Absorbance(d) graphs.

CONCLUSIONS

The molecule has in its neutral form, a low interaction with water, however, we believe that the micro-solvation of important regions of the structure can be critical for the electronic transition energies of the molecule. The next step is to do the same type of study to the charged form of the drug, which is found at physiological pH.

ACKNOWLEDGMENTS

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