Modeling the Electronic Absorption and Circular Dichroism Spectra of a Photo-switchable Bistable Peptide

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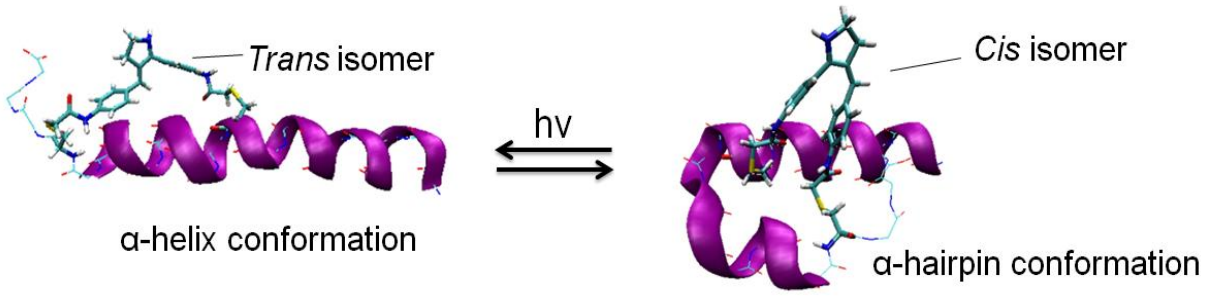
The control of biomolecular systems can be achieved through the application of photo-switches. Especially, a retinal like photo-switch based on E/Z photo-isomerization was experimentally shown to be a relevant candidate for reversible control of the alpha helix peptide conformation [1].

Here, we focus on the understanding of the mechanism leading to the final response of the overall peptide. More in detail, molecular dynamics simulations were performed for the E- and Z-isomer linked peptide, as well as for the unlinked peptide, in order to reveal the overall conformational changes induced by the attachment of the photo-switch. Our results, supported by experimental data [1], show on average how the unlinked peptide is partially unfolded in water, whether the E-isomer linked peptide tends to increase the helical content, and the Z-isomer linked peptide produces peptide bending leading to an alpha hairpin conformation (see Figure).

In order to monitor the photo-switch conformation, its electronic absorption properties were calculated along the trajectory at the CASPT2//CASSCF/AMBER level of theory, while a spectral signature of the overall peptide conformational change was recorded by modeling the circular dichroism spectra in the framework of the Frenkel exciton theory [2,3] at the M062X/AMBER level of theory, including a polarizable force field.



[1] M. Blanco-Lomas, S. Samanta, P. J. Campos, G. A. Woolley, D. Sampedro, *J. Am. Chem. Soc.*, **2012**, *134*, 6960-6963.
[2] V. I. Prokhorenko, D. B. Steensgaard, A. R. Holzwarth, *Biophys. J.*, **2003**, *85*, 3173-3186.
[3] H. Gattuso, X. Assfeld, A. Monari, *Theor. Chem. Acc.*, submitted.