Peptoids as Promising Azobenzene Support for the Chemical Storage of Solar Energy

Benjamin Tassignon [1,2], Gwendal Henrard [1,2], Julien De Winter[1], Jérôme Cornil[2] and Pascal Gerbaux[1].

[1] *Organic Synthesis and Mass Spectrometry Laboratory, Interdisciplinary Center for Mass Spectrometry, University of Mons – UMONS, 23 Place du Parc, B-7000 Mons, Belgium (benjamin.tassignon@umons.ac.be);*
[2] *Laboratory for Chemistry of Novels Materials, Center of Innovation and Research in Materials and Polymers, University of Mons – UMONS, 23 Place du Parc, B-7000 Mons, Belgium*

Storing solar energy represents a major challenge in modern science. Chemical storage with **MO**lecular **S**olar **T**hermal systems (**MOST**) appears promising though challenging. The working principle of those systems is based on iterative closed cycles of photoisomerization and back-isomerization between a parent compound and its metastable isomer. Energy is stored within the metastable isomer which possesses a certain half-life time and thermal energy is released during the thermal back-isomerization process. Among the MOST systems, azobenzene with its E→Z photoisomerization has been studied but characteristics such as storage enthalpy and half-life time must be improved. To do so, anchoring chromophores on a macromolecular backbone appears to be an elegant strategy since cooperative effects between chromophores may help enhancing these properties [1-2].

Our work consists of producing new MOST systems based on a peptoid-type backbone supporting azobenzene chromophores at key positions. This backbone could allow cooperative effects since peptoids belong to foldamers family and can thus adopt specific secondary structures in solution [3].

In this presentation, we will first talk about the synthesis of different peptoids containing azobenzene(s) at key positions using an on-resin solid support protocol. We will then describe the methodology developed for the complete determination of the MOST properties, *i.e.* UV-Vis absorption, molar extinction coefficient, photoisomer thermal half-live times and stored enthalpy. We will further discuss about the impact of the chromophore position(s) on the peptoid backbone on the MOST properties, revealing that position switching may allow tuning the azobenzene MOST properties depending on the targeted application. Finally, based on circular dichroism data, we will study the influence of the macromolecule conformation on the chromophore properties, since interactions between different azobenzenes on a single peptoid backbone are determining the switching properties of these chromophores.

[1] Zhang, B.; Feng, Y.; Feng, W. Springer Nature Singapore, 14, 2022.
[2] Wang, Z.; Erhart, P.; Li, T.; Zhang, Z. Y.; Sampedro, D.; Hu, Z.; Wegner, H. A.; Brummel, O.; Libuda, J.; Nielsen, M. B.; et al. Joule 2021, 5 (12), 3116–3136.
[3] Wu, C. W.; Sanborn, T. J.; Zuckermann, R. N.; Barron, A. E. J. Am. Chem. Soc. 2001, 123 (13), 2958–2963.