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

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**Introduction: a matter of storage**

Storing solar energy represents a major challenge in modern science. Several storage concepts have already been studied and among them, chemical storage with MOlecular Solar Thermal systems (MOST) appears promising though challenging [1]. The working principle of these systems is based on iterative closed cycles of photoisomerisation and back-isomerisation between a parent compound and its metastable isomer (Figure 1). Energy is stored within the metastable isomer which possesses a certain half-life time and thermal energy is released during the thermal back-isomerisation process [1,2]. Among the MOST systems, the azobenzenes chromophore with its E → Z photoisomerisation has been largely explored (Figure 1). However, the properties of the azobenzenes compounds must be improved for MOST applications, especially due to the low storage enthalpy (ΔH) and half-life times (t½) encountered to date for these molecules [1,3].

Improving azobenzenes MOST properties: our strategy

**Goal of the study**

- **Pepitoid of interest**
  - **Z isomer**
  - **E isomer**

**Position effect**

**Methanol, 20°C**

<table>
<thead>
<tr>
<th>E isomer</th>
<th>Z isomer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark</td>
<td>10 min UV</td>
</tr>
<tr>
<td>31%</td>
<td>30%</td>
</tr>
<tr>
<td>74%</td>
<td>69%</td>
</tr>
</tbody>
</table>

- **Position effect**
  - **Dark**
  - **10 min UV**
  - **10 min PV/SS**
  - **1h PV/SS**
  - **1h UV**

**Retention time (min)**

<table>
<thead>
<tr>
<th>Position effect</th>
<th>Retention time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark</td>
<td>12</td>
</tr>
<tr>
<td>10 min UV</td>
<td>36</td>
</tr>
<tr>
<td>10 min PV/SS</td>
<td>12</td>
</tr>
<tr>
<td>1h PV/SS</td>
<td>36</td>
</tr>
<tr>
<td>1h UV</td>
<td>12</td>
</tr>
</tbody>
</table>

**Further treatments**

- **Irradiation stopped**
- **Fast at start...**
- **slower at the end**

**Multi-azo peptoids: interaction between the chromophores**

- **Photoisomerisation**
- **Retention time (min)**

**Storing the dark at 23kC**

- **UV irradiation**
- **Photoisomerisation**

**Conclusion**

In this work, we used peptoids as azobenzene support to store solar energy in the context of MOlecular Solar Thermal systems (MOST). With the development of a LC-MS based method, we extracted interesting properties especially a high site selectivity from the peptide backbone observed with simple systems. Indeed, depending on the anchoring position, t½ ranging from not detectable to 14 days were obtained for the azobenzenes. A peptoid containing 2 chromophores was also investigated, and the LC separation prior to MS analysis allowed us to identify the four isomers but also to evidence the absence of interactions between the azobenzenes at these positions. This study paves the way for future development in solar energy storage.

**Acknowledgements**

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**References**