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Towards the Second Generation of Light Effected Autonomous Molecular Pumps

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The development of molecular devices able to operate autonomously away from equilibrium when subjected to an external source of energy and to perform a task, still represents one of the major challenges in supramolecular chemistry, with very few examples available. We recently reported the synthesis of a pseudorotaxane composed by a crown ether macrocycle (1) and a non-symmetrical thread (2) consisting of a photoisomerizable azobenzene unit, a secondary ammonium station and a cyclopentyl pseudostopper. We demonstrated that, upon light irradiation, the system acts as a molecular pump allowing the unidirectional transit of the thread through the macrocycle in a dissipative way, operating cyclically according to energy and information ratchet mechanisms. Our recent work focused on the modification of the pump module, in order to improve it and introduce it in more complex architectures such as catenanes, liposomal bilayers and polymers. In particular, the use of a phenylene derivative as new pseudostopper (3) allowed to expand the system to include a reservoir, thus pumping, and potentially trapping, the macrocycles in a higher energy state once light of the appropriate wavelength is shined upon the system (Fig. 1b).

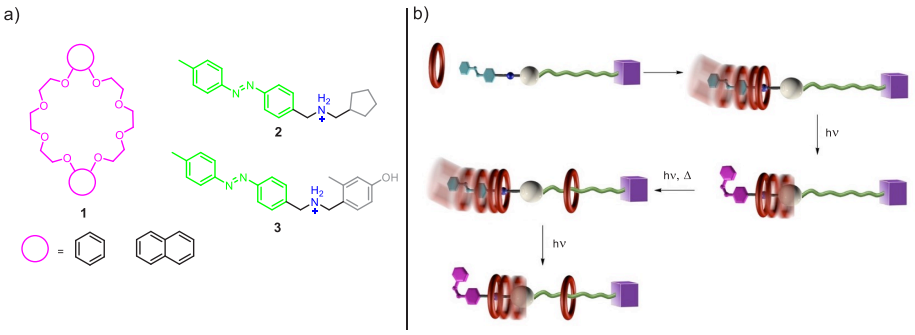

Figure 1. a) Structures of the components of the pumping module. b) Schematic representation of the reservoir modified pump working mode.

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ISOF 12 – Meeting Room (1st floor)

CNR Research Area

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