Spiropyran onto siliceous mesoporous materials: developing a novel molecular gate

Elena Aznar[a], Rosa Casasús[a], María Comes[a], Beatriz García-Acosta[a], Félix Sancenón[a], María Dolores Marcos[a], Ramón Martínez-Máñez[a]
[a]Instituto de Química Molecular Aplicada, Departamento de Química, Universidad Politécnica de Valencia, Camino de Vera s/n, E-46022 Valencia, Spain.
rmaez@qim.upv.es

The anchoring of specific molecular entities not on "flat" surfaces (2D systems) but in 3D nanoscopic scaffolds offers the opportunity to develop and explore new functional supramolecular concepts for hybrid systems. One of these new functional concepts deals with molecular gates. Molecular gates are nanoscopic supramolecular architectures that incorporate functional chemical entities which can act as a gate and allow to control the access of a certain nanosite at will[1].

Mesoporous silica has been chosen as the 3D scaffold because of its unique properties such as its widely known functionalization chemistry and the controlled pore sizes in the nanometric range with a very narrow pore distribution due to a perfectly adaptable synthesis[2].

The inner pores of MCM-41 mesoporous materials were loaded with $[Ru(bipy)_3]^{2+}$ complex (absorption maximum at 454 nm). The external surface of the loaded solid was functionalised with spiropyran subunits that are light-switchable molecules (changes its structure and charge upon exposition to visible light)[3,4]. The release of the $[Ru(bipy)_3]^{2+}$ complex to the solution was studied in the presence of certain anions (ATP, cholic acid and carboxylate-containing dendrimers) in the dark and with visible light.

This novel approach is assumed to have a high potential for new advances in nanometric machine-like designs, complex delivery systems, and optical sensing.

References:

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Figure: Switching of spiropyran