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Nanocontainers: properties, manipulation and bio-medical applications

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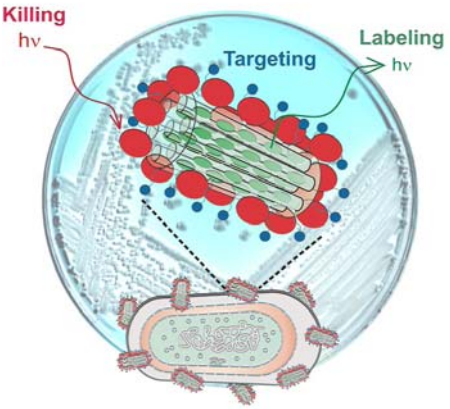
The creation of molecular (nano)containers: crystalline or amorphous, rigid or soft is a very fascinating field at the cross point of different disciplines. Our effort, in this talk, focuses on the synthesis and use of crystalline materials, zeolites L, which are transparent, stiff, nanocontainers. They are made of hundreds of parallel aligned unidimensional channels, which can be filled with molecular dyes or other responsive molecules. The selective and spatial resolved functionalization of these nanocontainers can lead to multifunctional systems [1]. Furthermore the selective functionalization of the channel entrances, lead to the self-assembling of the zeolites, and the assembly process can be extended to living organism such as bacteria [2]. The use of appropriate light responsive components in combination with the smallest zeolites (30 nm) has been very successfully applied for the labeling targeting and killing of antibiotic resistant bacteria (see figure) [3]. Using visible light we have been able to show that the antibiotic resistant bacteria can be efficiently killed even at very low light dose. The production of singlet oxygen is indeed the key for the cell death.



The toxicity of these materials has been tested with cells in order to understand the mechanism of the cell uptake, and the cell death or mutation upon zeolites internalization. Furthermore the functionalization of the external surface has been studied with a series of zeolites which contains negative and positive charges groups leading to different materials. The studies show that at low concentration none of the zeolites are toxic while at higher concentration the functionalization plays a very important role for the cyto-toxicity [4].

[1] M. Busby, H. Kerschbaumer, G. Calzaferri, L. De Cola *Adv. Mat.* **2008**, *20,* 1614
[2] Z. Popovic, M. Otter, G. Calzaferri, L. De Cola, *Angew. Chem. Ind.Ed.,* **2007,** *46*, 6188. Z. Popovic, L. De Cola et al. *Angew. Chem.*, *Ind. Ed***. 2007**, *46*, 8898.
[3] C. Strassert, M. Otter, R. Albuquerque, A. Höne, Y. Vida, B. Maier, L. De Cola *Angew. Chem. Int. Ed.* **2009***, 48,* 7928.
[4] Z. Li, L. De Cola to be submitted