Photoactive organic nanoparticles: how confinement effects can be harnessed to inform on their fate in water and cells?

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Fluorescent organic nanoparticles (FONs), exclusively composed of small hydrophobic dyes, have stimulated spectacular interest in the last decade for their potential use as ultra-bright labels in bioimaging up to the NIR range with no adverse toxicity effects like those encountered in heavy metal-containing nanoparticles.[1] More recently, their fabrication has been extended to the generation of photochromic organic nanoparticles (PONs). The latter display similar enhanced confinement phenomena that have mainly been exploited to develop photoswitchable labels for cell imaging and innovative super-resolution concepts.[2] Flash-nanoprecipitation turns to be the most commonly adopted process to generate such dye-based nanoparticles, issued from the non-covalent self-assembly of hydrophobic dyes in water. Surprisingly, whereas colloidal and chemical stabilities are systematically questioned in case of metallic nanoparticles, especially for biological purposes, they remain largely overlooked for organic nanoparticles. Through the survey of various studies conducted in water and in the presence of different cell lines, we will show how FONs and PONs, capable of solvatochromism, electronic energy or electron transfer, structurally evolve in the course of time and allow for drug delivery monitoring and photoinduced cell apoptosis (Figure 1).[3]

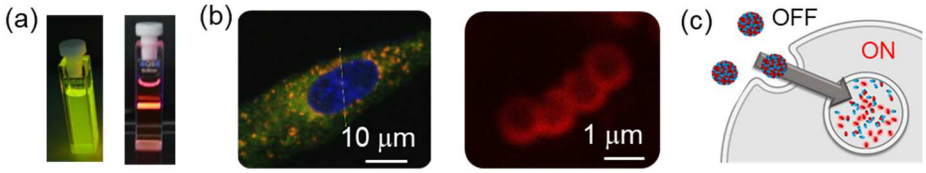

Figure 1. a) FONs in fatty media (left) and water (right). b) FONs labelling cancer cells (left) and *S. aureus* bacteria (right). c) Drug delivery monitoring after cell endocytosis.

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