Séminaire

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Amphithéâtre Henri Benoît

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Ultrabright Fluorescent Polymer Nanoparticles for Bioimaging

Fluorescent polymer nanoparticles encapsulating large quantities of dyes, so-called dye-loaded polymer nanoparticles (NPs), have emerged recently as an attractive alternative to inorganic fluorescent NPs, notably quantum dots.[1] These new nanomaterials can combine biodegradability and low toxicity with superior brightness. One of the major challenges in assembling dye-loaded NPs is to overcome aggregation caused quenching, which strongly limits the achievable brightness. We recently introduced a new approach to avoid dye aggregation through the encapsulation of charged fluorophores with bulky hydrophobic counterions (Fig. 1).[2] This counterion approach leads to a collective behavior of hundreds of dyes inside the nanoparticles resulting in ON/OFF-switching or blinking of the entire particle.

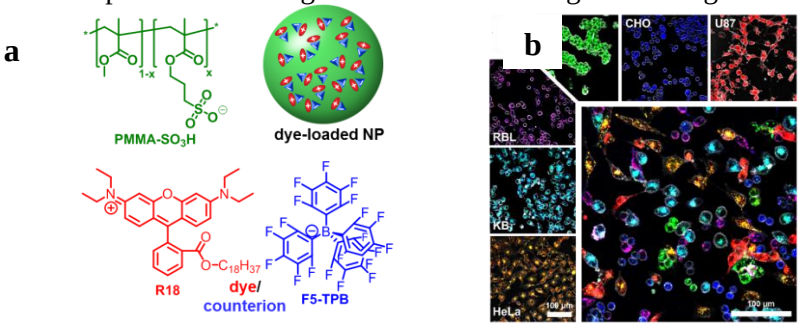

Figure 1: (a) Example of polymer, dye, and counterion used to assemble dye-loaded nanoparticles. (b) Nanoparticle based color coding of living cells.

Here I will present two examples of how relatively simple polymer chemistry can be used to control the formation and properties of these dye-loaded polymer NPs:

Variation in the hydrophobicity of the polymers used in nanoprecipitation and of the assembly conditions was used to tune the dye organization inside the polymer matrix. This allowed to tune particle blinking and to create non-blinking particles.[3,4] Introducing small amounts of charged groups into the polymers enabled preparation of polymer NPs with controlled sizes from 50 down to 7 nm, *i.e.* close to those of proteins (Fig. 2).[5,6] Small particle sizes proved beneficial for the spreading and diffusion of the NPs inside living cells. Based on these NPs a technology for long-term fluorescence labeling of living cells with programmed RGB color codes is presented (Fig. 2).[7]

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