Silica nanoparticles for diagnostic applications

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Thanks to their unique features of shape, size and charge, nanoparticles (NPs) appeared to be good candidates as diagnostic tools especially conjugated to antibodies for immunofluorescence assays.

AcZon NPs are dye doped core-shell silica nanoparticles, synthesized through a micelle-assisted method deriving from the well-known Stöber process. While traditional fluorochromes are still affected by lack in stability and low intensity emission in water solution, these fluorescent NPs are emerging as promising probes allowing to overcome these limits. Silica was chosen because it has proven to be an excellent material: it is photophysically inert, not involved in energy or electron transfer processes and, moreover, intrinsically non-toxic (opening to future possible in vivo applications). The most innovative feature of AcZon NPs is the ability to be a platform where the fluorescence energy transfer process, known as FRET, occurs at a high efficiency rate. Besides being the most used “stealth” polymer in the drug delivery field, polyethylene glycol (PEG) allows to modulate the type and number of functional groups (e.g., amine, thiol, carboxyl or methacrylate) exposed on the external shell of NPs. As a consequence, PEG properties lead to the conjugation of several biomolecules on AcZon NPs. Amine reactive groups, for instance, can be linked to monoclonal antibodies via crosslinkers, through a site-specific conjugation, preserving antibodies biological activity. The conjugated antibody thus obtained shows improved qualities with respect to the conventional counterpart.

The optimization of a product starting from literature is a hard work especially in a relatively new field as nanotechnology. The increasing efforts towards a safe and equally important, sustainable design will be of help for saving time and money. Our experience in this field is fairly new but we can already state how this new approach will be important for future developments.