Development and characterization of fluorescent dye-doped nanoparticles with enhanced fluorescence intensity and photostability

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We report the development of fluorescent dye doped organosilicate nanoparticles (DOSNPs) synthesized from poly-methylsilsesquioxane(PMSSQ), resulting in high fluorescence intensity and excellent photostability. The surface modified DOSNPs have hydrophilic surfaces and hydrophobic cores that enhance water-solubility and protect the dyes from oxidation and phtobleaching. These DOSNPs show superior properties over conventional dyes such as high fluorescence intensity due to approximately hundred dye molecules per particle and photostability demonstrating 7% and 76% fluorescence decay under continuous excitation for rhodamine 6G (R6G) DOSNP and R6G molecules, respectively, and have potential to be used in many areas, for example, imaging, sensing and solar cells.

DOSNPs, when conjugated to anti-fibronectin antibodies, increased sensitivity of detection by approximately 600 fold relative to individual dye molecules conjugated to antibody. The DOSNPs are being applied to the development of diagnostic devices to be used in the detection of drugs, metabolites and pathogens.