Preventing the toxicity of ZnS:Mn nanoparticles in aquatic media, using the sol-gel technology

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ZnS nanoparticles (NPs) find applications in many fields: e.g. biolabels multicolors displays, due to their additional physico-chemical properties, especially when they are doped with paramagnetic metal cations, like Mn^{2+}. However, the toxicity of such NPs remains little explored, they may have some uncontrolled toxicological effects on the living microorganisms after they are disposed in the environment, such as water, soil and sediments. So, the idea is to coat the NPs with a silica shell, made by hydrolysis and condensation of TEOS, by reverse microemulsion, as a protective barrier to prevent the toxicity of the NPs. Moreover, these particles mimic well some complex electroluminescent devices made of quantum dots (QDs) and silica used as a dielectric.

In our work, the ZnS:Mn NPs were produced by *chimie douce*, using the polyol method; the NPs are blende cubic single crystals of 6-7 nm in size. They were then coated by silica, by reverse microemulsion method, using TEOS as a precursor, through a water-in-oil (W/O) microemulsion. The size of the resulting core-shell ZnS:Mn@SiO_2 was about 40 nm, aggregates of NPs being embedded in silica, mimicking well the devices mentioned aforementioned.

We will present the toxicity of ZnS:Mn NPs towards microalgae (namely, Chlorella Vulgaris) evidenced by a decrease of the photosynthetic activity and the viability of the algae; however, after coating with a sol-gel silica shell, the toxicity of the NPs decreased, clearly demonstrating the interest of the sol-gel process to produce protective barriers to inhibit the toxicity of such NPs.