

CANdots: Applications of fluorescent nanoparticles in Biomedicine and Life Sciences

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Inorganic nanoparticles have high potential for applications in the biomedical sector. Nanoparticles are very promising diagnostic and therapeutic agents. II-VI semiconductor quantum dots, such as CANdots, are used as target diagnostic cancer-imaging agents, as aids to optically guided surgery, as smart drug-delivery systems and as biosensors. Compared to commonly used organic fluorophores, fluorescent nanoparticles have a variety of advantages such as narrow emission spectra, broad absorption spectra, a tunable emission according to their size and above all their excellent resistance to photobleaching.

CANdots (Series A) are fluorescent nanoparticles covering the visible wavelength range from 480 to 620 nm. They are soluble in nonpolar organic solvents or in aqueous solvents, depending on their tailor made organic shell. An innovative, patent-protected production process allows production even of larger amounts of nanoparticles at a much lower cost than before. Another advantage over previous production processes is the very good reproducibility of particle properties. Research facilities as well as product development will profit from this never before achieved reproducibility. Recently, CAN GmbH used those particles for a systematic study of biological responses to nanoparticle exposure as a function of particle size, material composition, shape, and organic passivation. Automated high content analysis and commonly available toxicity assays were used to assess physiological responses, such as apoptosis, necrosis and stress in cell culture models which depict the main human exposure sites to nanoparticles. Live cell confocal microscopy revealed the uptake and localisation of nanoparticles within the cells. First results in conjugating the nanoparticles to biological molecules and *in vitro* experiments using cell culture models are shown. Combining the highly defined nanoparticle-characteristics as a toolbox and the patterns of biological responses gives us information, whether certain nanoparticles have harmful effects on cells or not. The multiparameter-analysis of the data describes predictable nanoparticle-cell-system effects. The assessment of the biological response is based on a standardized procedure which ensures the rating. Monitoring the biocompatibility of nanoparticles is necessary in order to guarantee the harmlessness of these systems.