Abstract

Nanodiamonds (NDs) are an interesting platform in biological applications and disease treatment. Because of their photoluminescence properties and modifiable surface, they have been investigated as potential carriers for drugs and nucleic acids as well as fluorescent probes. In order to design NDs meeting specifically desired parameters, which would succeed in clinical trials and in medicinal therapy, understanding the mechanism of uptake and intracellular fate of NDs is crucial. The diploma thesis is focused on mechanistic investigation of ND-based nanoparticles delivering nucleic acids to human cells. First, NDs coated with a novel cationic co-polymer were prepared. NDs were then complexed with siRNA in order to transfect siRNA inside U-2 OS cells. NDs proved to be biocompatible and effective transfection particles as observed by qPCR and colorimetric cytotoxicity and cell viability tests. To examine ND uptake by cells, we inhibited endocytosis by specific inhibitors. Obtained results implicated that ND uptake was clathrin- and caveolin dependent. Nonetheless, more than half of NDs was internalized by cells in a different fashion. Some NDs colocalized with early endosomes, lysosomes and caveolin-derived endosomes after internalization. Other NDs resided either in unknown cell structures or escaped from endosomes to cytoplasm early after cell entry. In this work, we deepened our knowledge about NDs' cell uptake and their consecutive subcellular localization.