Functionalization and Cytotoxicity Studies of Nanodiamonds

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Abstract:

Owing to their unique chemical and physical properties, carbon nanomaterials (*e.g.* carbon nanotubes, nanodiamonds) are attractive for a variety of biological applications, including carriers for drugs, genes, proteins, or vaccinations; novel imaging enhancement agents; tissue scaffold design; and many other emerging technologies. For these applications, few chemical functionalization methods have been devised to solubilize carbon nanotubes and nanodiamonds in aqueous solution, which may also render them biocompatible. However, there is a lack of data characterizing the interactions between nanomaterials and cells. The cell cytotoxicity study of these carbon nanomaterials is critical for understanding the parameters (e.g. length, mass, functionalization density), which influence their biocompatibility or cytotoxicity. Our recent work on cytotoxicity of carbon nanomaterials indicated that well-dispersed nanodiamond particles of 2-10nm in size can be rendered soluble in aqueous media through chemical functionalization with either acids or bases and are non-toxic to neuroblastoma cells after 24 hours of incubation at concentrations ranging from 5-100 μg/ml. However, under the same conditions, various other carbon-based materials (fine carbon black, single and multi-walled carbon nanotubes) can be more toxic to the cells. These results suggest that nanodiamonds may be ideal for biocompatible implants or devices.