New Biocompatible Carbon Nanoparticles: Synthesis, Properties, Biomedical and Ecological Application

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Synthesis of novel biocompatible fluorescent nanomaterials is prospective for biomedical research purposes as the potential alternatives to the highly toxic carbon nanotubes, fullerenes and heavy metals' oxides quantum nanoparticles. Herein we describe a method of synthesis, purification, evaluation and biological effects of the citric acid, carbamide and other simple organic compounds derived fluorescent carbon nanoparticles in time and temperature controlled conditions. Hydrothermal combustion was implemented for derivation of the carbon nanoparticles with subsequent chromatography purification. Fluorescence spectroscopy was applied for excitation and emission spectra determination. It was shown that at the start of synthesis, rapid increase in fluorescence (em. 440 nm) was observed indicating the formation of a fluorescent substance. Further heating yielded new fluorescent peaks (em. 530nm) possibly through the formation of carbon nuclei through polymerization. Agarose electrophoresis was implemented for size and charge separation in parallel with fluorescence visualization. Obtained fluorescent nanoparticles were subjected to general toxicity bioassay with Daphnia magna and specific toxicity testing on HeLa cell line in vitro indicating that obtained fluorescent nanoparticles are biocompatible, show positive tropism to cells and therefore could be considered suitable for further bio functionalization. The results of the study indicate a suitable method of hydrothermal synthesis of fluorescent carbon nanoparticles from simple organic compounds. Derived nanomaterials possess unusual fluorescence characteristics, show suitable biocompatibility and therefore can be used for advanced functionalization as the environment-friendly fluorescent markers.

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