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Investigation of the cellular uptake of functionalised carbon nanoparticles

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Nanomaterials possess excellent structural, electronic and optical properties and are seen to offer huge potential in nanomedicine applications. Due to their biocompatible chemical composition, carbon nanoparticles have received significant attention in recent years, yet many fundamental questions still remain about their mechanism of internalisation by cells. The aim of this project is to address this lack of knowledge for two forms of carbon particles, Carbon Nanohorns (CNHs) with high surface area and chemical inertness, and carbon nanodots (C-dots) that display good water dispersibility, chemical inertness and high biocompatibility. A range of chemical synthesis methods were used to generate C-dots. These were characterised using a range of techniques including AFM, DLS and FTIR and their cellular uptake was assessed by utilising *in vitro* HeLa cell-based assays to determine how internalisation occurs and the pathways they follow in cells. Three families of C-dots have been successfully synthesised by three different approaches, namely microwave, electrochemical and solvothermal synthesis. The resulting C-dots showed emission profiles in the blue, green and red parts of the spectrum under different excitation conditions. A maximum emission peak at 500 nm is observed when the green C-dots are excited at 440 nm, whereas the CNHs emit at 568 nm when excited at 551 nm. Upon characterisation, AFM and DLS methods determined the average diameter of the C-dots and CNHs to be ~ 4 nm and 198 nm respectively. MTT cytotoxicity assays suggest that the blue and red C-dots do not induce any significant toxicity to cells, while the green C-dots at 25 μg/mL cause an approximately 60% reduction in cell viability. Overall, different classes of carbon nanoparticles with low cytotoxicity can be readily synthesised and subsequently utilised to study their trafficking in mammanlian cells. Future work will focus on unravelling the specific pathways involved in this trafficking process with a view to better designing carbon nanomaterials to act as vehicles for drug delivery.

Biography

Badriah Hifni received her Master's degree at King Abdulaziz University of Jeddah (Saudi Arabia) for her work on the genotoxicity and cytotoxicity of carboplatin in somatic and germ cells of adult male swiss albino mice under the supervision of Dr. Salwa Mohammad. Currently, she is in her third year of Doctor of Philosophy (PhD) program at University College Dublin. The focus of her PhD is the investigation of the cellular uptake of functionalized carbon nanoparticles under the supervision of Prof. Jeremy Simpson and Dr. Susan Quinn.

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