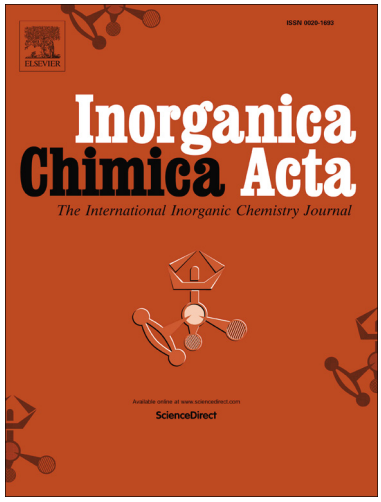

Review article

Carbon nano-onions in biomedical applications: promising theranostic agents

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Carbon nano-onions in biomedical applications: promising theranostic agents

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The authors dedicate this article to Prof. Luis Echegoyen

Abstract

Carbon nano-onions (CNOs) are an emerging class of nanoparticles which shows great potential in a number of different applications, including electronics [1, 2], catalysis [3, 4] and tribology [5, 6]. Carbon nano-materials have been widely explored in biological cell imaging, due to their lack of toxicity, and biosafety. Recently, the rapid development and availability of chemical surface modification methods have made it possible to explore these cage-in-cage structured nanoparticles as novel systems for biological applications. The functionalization of CNOs with different functional groups improves their solubility and biocompatibility, resulting in an increased ability to penetrate into the cells. Moreover, their small size and high surface area allow for the conjugation of different diagnostic and therapeutic agents, opening new avenues in theranostic applications. In this review article, we discuss the latest advances reported by our group regarding the use of CNOs for biomedical applications and our findings confirm their great potentiality as promising platform for novel therapeutic approaches.

Keywords: carbon nanomaterials; imaging; fluorescence; nanomedicine

Introduction

Carbon nano-materials (CNMs), since the discovery in 1985 of a new allotropic form of carbon known as C_{60} fullerene by Kroto, Curl and Smalley [7], have been object of an intense scientific research for possible applications in a wide range of fields. A prominent position, due to their intriguing properties, is occupied by carbon nano-onions (CNOs), often known as onion-like carbon (OLC). CNOs (Figure 1) are multi-shell fullerenes consisting of quasi-spherical nested graphitic layers with a size ranging from 2 to 50 nm, depending upon the method of synthesis; the innermost