BJPS

Brazilian Journal of
Pharmaceutical Sciences
vol. 49, n. 4, oct./dec., 2013

Article

Carbon nanotubes as a novel drug delivery system for anticancer therapy: a review

Swatantra Kumar Singh Kushwaha[1,*], Saurav Ghoshal[1], Awani Kumar Rai[1], Satyawan Singh[2]

[1]Pranveer Singh Institute of Technology, Kanpur, India, [2]Saroj Institute of Technology & Management, Lucknow, India

Carbon nanotubes (CNTs) were discovered in 1991 and shown to have certain unique physicochemical properties, attracting considerable interest in their application in various fields including drug delivery. The unique properties of CNTs such as ease of cellular uptake, high drug loading, thermal ablation, among others, render them useful for cancer therapy. Cancer is one of the most challenging diseases of modern times because its therapy involves distinguishing normal healthy cells from affected cells. Here, CNTs play a major role because phenomena such as EPR, allow CNTs to distinguish normal cells from affected ones, the Holy Grail in cancer therapy. Considerable work has been done on CNTs as drug delivery systems over the last two decades. However, concerns over certain issues such as biocompatibility and toxicity have been raised and warrant extensive research in this field.

Uniterms: Carbon nanotubes/properties. Carbon nanotubes/use/drugs delivery. Single-Walled Carbon Nanotube. Multiwalled Carbon Nanotube. Anticancer drugs/delivery. Cancer/therapy. Drugs/delivery.

Os nanotubos de carbono foram descobertos em 1991 e suas propriedades físico-químicas únicas demonstradas, despertando interesse em sua aplicação em vários campos, incluindo a entrega liberação de fármacos. As propriedades únicas dos nanotubos de carbono, tais como a facilidade de captação pela célula, carga alta de fármaco, ablação térmica, entre outras, tornaram-nos úteis para terapia de câncer, uma das doenças mais difíceis dos tempos modernos, pois sua terapia envolve a distinção entre as células normais saudáveis e as afetadas pela doença. Os nanotubos de carbono têm um papel importante nessa área porque fenômenos como EPR permitem que estes possam distinguir as células normais das afetadas, que é o Santo Graal na terapia do câncer. Trabalho considerável tem sido feito ao longo das duas últimas década com nanotubos de carbono, como sistemas de liberação de fármacos. No entanto, preocupações sobre algumas questões, como biocompatibilidade e toxicidade, surgiram ao longo do tempo, demandando extensas pesquisa nesse campo.

Unitermos: Nanotubos de carbono/propriedades. Nanotubos de carbono/uso/liberação de fármacos. Nanotubo de carbono de parede única. Nanotubo de parede múltipla. Fármacos anticancer/liberação. Cancer/tratamento. Fármacos/liberação.

INTRODUCTION

Cancer ranks amongst the top three killers in modern society, next to heart and cerebrovascular diseases. In 2009, approximately eight million people died from cancer worldwide according to the WHO. The chemotherapeutic agents used for the treatment of a range of cancers are always associated with severe, sometimes fatal, toxicity due to a lack of target specificity (Alderton *et al.,*1992). Several attempts have been made to reduce this serious side effect, for example by liposomal encapsulation of doxorubicin (Chon *et al.,*1995). Additionally, active drug targeting strategies are being developed to further enhance selectivity. Ever since their discovery in 1991 by Iijima (Iijima, 1991), there has been intense interest in allotropes of carbon due to their unique physical and chemical properties, emerging as promising candidates for a multimodal drug delivery systems. They not only allow for the attachment of multiple copies of drug molecules, but can also be equipped with targeting agents and stealth molecules to evade clearance by the immune system. Furthermore, they hold several potential

***Correspondence:** Swatantra Kumar Singh Kushwaha. Department of Pharmacy, Pranveer Singh Institute of Technology, 208020 - Kanpur, India. E-mail: swatantrakushwaha@yahoo.co.in