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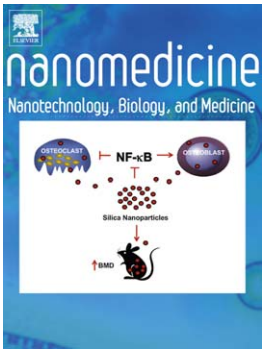

Advances in silica based nanoparticles for targeted cancer therapy

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Advances in silica based nanoparticles for targeted cancer therapy

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Abstract: Targeted delivery of anticancer drug specifically to tumour site without damaging normal tissues has been the dream of all scientists fighting against cancer for decades. Recent breakthrough on nanotechnology based medicines has provided a possible tool to solve this puzzle. Among diverse nanomaterials that are under development and extensive study, silica based nanoparticles with vast advantages have attracted great attention. In this review, we concentrate on the recent progress using silica based nanoparticles, particularly mesoporous silica nanoparticles (MSNs), for targeted drug delivery applications. Firstly, we discuss the passive targeting capability of silica based nanoparticles in relation to their physiochemical properties. Then, we focus on the recent advances of active targeting strategies involving tumour cell targeting, vascular targeting, nuclear targeting and multistage targeting, followed by an introduction to magnetic field directed targeting approach. We conclude with our personal perspectives on the remaining challenges and the possible future directions.

Keywords: silica nanoparticles; active targeting; passive targeting; magnetic field directed targeting; cancer therapy

1. Introduction

Cancer has been among the leading cause of death worldwide. Current cancer treatments are mostly relying on radiation and chemotherapeutic agents, which suffer from severe side effects due to non-specific damage towards normal tissue and cells. Therefore, targeted drug delivery and release to tumour sites is of great importance for minimised side effects and enhanced therapeutic efficiency. In recent decades, the development of nanotechnology based medicine (nanomedicine) has made great breakthrough in the pharmaceutical and biotechnology fields[1-3] since the discovery of the first drug delivery system using liposomes in the 1960s.[4] Later on, a wide range of nanomaterials have been developed for drug delivery, including polymers, liposomes, silica, metal oxides and semiconductor nanocrystals.[5] Liposomes are extensively used nanocarriers in biomedical field since their discovery by Bangham and coworkers approximately 40 years ago.[6] However, liposomes suffer from relatively