



BOOK OF ABSTRACTS

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Design of Hydrophobic–Hydrophilic copolymer Coated γ -Fe₂O₃ Nano-carriers for Biocompatible and Targeted Chemotherapy Applications

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Abstract

The threat of cancer is increasing globally, along with the growing number of cancer patients. Cancer is the second worldwide cause of mortality. This trend is largely due to the lack of effective early detection techniques and limitations in current therapeutic strategies. The high doses of drugs used in chemotherapy lead to severe adverse side effects and damage healthy cells because of poor targeting specificity toward cancerous cells. Inhibition of cancer cell growth can be achieved through appropriate treatment at the early stages of the disease. Therefore, the development of suitable targeted drug carriers is pivotal important for cancer therapy. For this application, nanoparticles must possess a combination of high magnetic saturation, biocompatibility, and functional surface interactions. In addition to being non-toxic and biocompatible, iron oxide nanoparticles should prevent the opsonization process and remain stable within the reticuloendothelial system. This study focuses on the synthesis of stable, biocompatible magnetic drug delivery vehicles based on polylactic acid (PLA)–polyethylene glycol (PEG) copolymer–functionalized superparamagnetic γ -Fe₂O₃ nanoparticles for targeted anticancer drug delivery in biological systems. The inner core of the copolymer is formed by the hydrophobic PLA polymer, which binds to the surface of γ -Fe₂O₃ nanoparticles, while the hydrophilic PEG polymer forms the outer layer, enabling the attachment of the anticancer drug doxorubicin through hydrogen bonding. The outer PEG layer reduces particle aggregation and enhances stability in biological fluids. Cytotoxicity tests were performed using normal cell lines through MTT assays on uncoated, copolymer-coated and drug-conjugated copolymer-coated γ -Fe₂O₃ nanoparticles. The results revealed that uncoated, copolymer-coated and drug-conjugated copolymer-coated γ -Fe₂O₃ nanoparticles exhibit good biocompatibility with healthy cells, supporting their potential application as magnetic nanocarriers for chemotherapy.

Personal Profile

Professor Subhasis Rana obtained his Ph.D. in 2004 at Indian Institute of Technology, Kharagpur in the area of nanostructured materials and he has two foreign postdoctoral experiences at the University of Louisiana at Lafayette, USA (2003 – 2006) and Stockholm University, Arrhenius Laboratory, Sweden (2007-2008). Following his postdoctoral work, he served as a Visiting Scientist at the Indira Gandhi Centre for Atomic Research (DAE), Kalpakkam; the Central Glass & Ceramic Research Institute (CSIR), Kolkata; and the Variable Energy Cyclotron Centre (DAE), Kolkata, India. Prof. Rana is currently an Associate Professor at the University of Engineering and Management, Newtown, Kolkata. His research interests focus on the synthesis of advanced nanomaterials for biomedical and energy-related applications. His notable research contributions are diabetes detection from breath, removable magnetic photocatalyst, targeted drug delivery, formation of superlattices of iron oxide nanocrystals and 2-Dimensional nanomaterials such as Graphene and Mxene.

Prof. Rana has published more than 40 research articles in highly reputed, peer-reviewed journals and has received over 2,600 research citations. He holds US, European, Japanese, and Korean patents for his innovative work on diabetes detection through breath analysis using a nanostructured gas sensor.

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