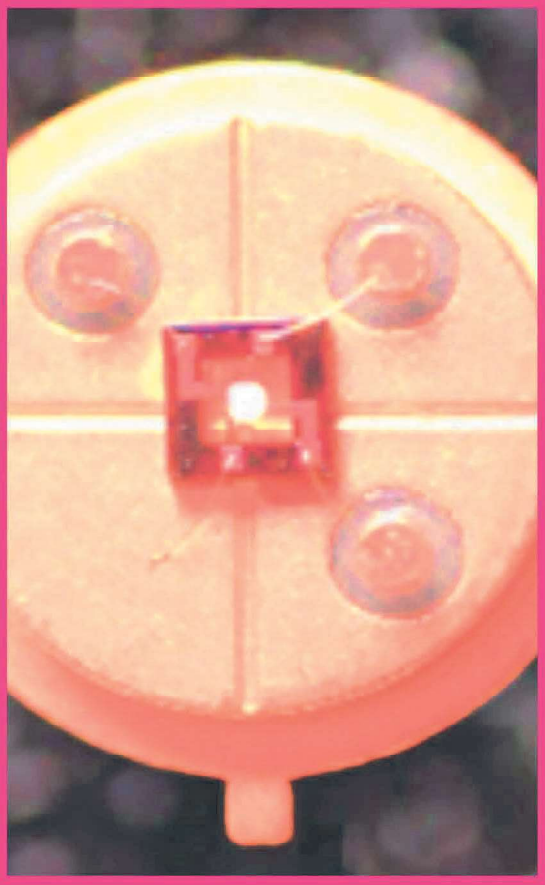

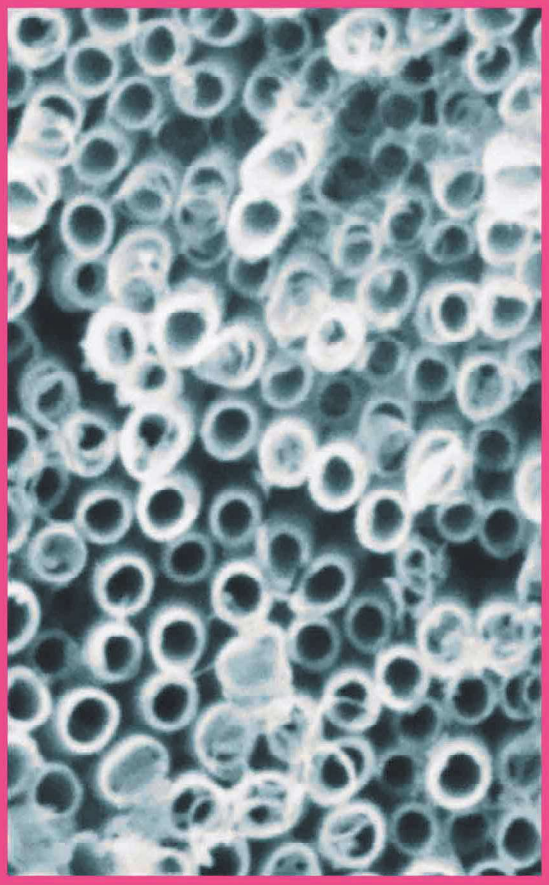

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6 Engineered Nanoparticles for Drug Delivery System

Soumik Podder, Subhrajit Chowdhury, Bishal Sarkar, Priyanka Daw, Aneek Nath, and Anurup Nag

6.1 INTRODUCTION

Nanomaterials belong to a specific branch of materials whose at least one-dimensional measurement is between 1 and 100nm. Natural materials can be converted into nanomaterials either by a top-down or a bottom-up approach as per the user's requirements. Nanomaterials generally possess unique physicochemical properties such as optical, magnetic, catalytic, electrical characteristics and so on. The structural miniaturization in nanomaterials produces significant elevation in surface energy due to exposure of more dangling or unsatisfied chemical bonds in the enhanced surface area. The surface energy essentially brings fascination in the aforementioned properties. Nanomaterials, based on their dimensional miniaturization, are classified into three major categories: 1) Three-dimensional nanoparticles (3DNPs), 2) Two-dimensional nanoparticles (2DNPs) and 3) One-dimensional nanoparticles (1DNPs). Zero-dimensional quantum dots (0DQDs) have exhibited breakthrough optical, magnetic and catalytic properties due to a strong electron confinement effect.[1]

In practice, spherical NPs are available most as they are easy to synthesise through a simpler wet chemical process. The smaller-sized NPs are preferred in biomedical applications, particularly in the drug delivery system, due to higher drafting density, but for specifically targeting the affected cell, rod-shaped and star-shaped NPs are preferred.[2,3] Rod-like morphology exhibited enhanced luminescence properties that are helpful in cellular imaging and tracking of the drug.[4] As a whole, NPs offer excellent retention possibility, high chemical endurance, proven low cytotoxicity and biocompatibility.[5] Nowadays the term 'engineered' is often used, especially in nanotechnology. Engineered nanotechnology is conceptualized as tailoring the surface energy or surface area of bare NPs for enhancement in their activity. Tailoring in surface energy is performed by the use of surfactant or a capping agent. The use of a capping agent reduces the size of the bare NPs so as to inhibit agglomeration. Therefore, the employment of a capping agent automatically enhances the surface energy of the NPs and consequently facilitates the penetration of the NP-coated drugs to the target cell. This capping-inspired engineering in NPs is primarily observed in metal and metal-oxide NPs. Polymers are generally used as a capping agent in NPs.

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