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REVIEW ARTICLE

Recent advances in self-assembled cyclic peptide-based smart nanostructures

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ABSTRACT

Peptide chemistry has emerged as one of the growing fields of research. Peptide chemistry has positively impacted various areas, including biochemistry, medicine, hormonal therapy, drug delivery, food and the cosmetic industry, materials science, and nanotechnology, via the development of ways to change and imitate the shape and function of peptide structures. The structural changes of peptides and the employment of innovative synthetic techniques have left an indelible mark on a number of scientific disciplines. Numerous nanostructures based on simple and complicated peptides have been constructed so far; however, cyclic peptides have attracted a great deal of interest from the scientific community due to their wide range of applications and distinctive properties. These properties include self-assembly, morphogenesis, and charge distribution, among others. In addition, nanostructured cyclic peptides offer increased and effective performance due to their high stability, prolonged plasma half-life, membrane permeability, and efficient transport, among other attributes. Recent work indicates the manufacture of nanostructured cyclic peptides by chemical means. In this review, a brief investigation of the morphology of cyclic peptides was conducted. In addition, the therapeutic potential of these nanostructured cyclic peptides and the prognosis for a variety of potential applications are also discussed.

Keywords: Peptides; Cyclic Peptides; Therapeutic; Nanotubes; Nanowires; Nanospheres; Drug Delivery

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1. Introduction

The human body is composed of proteins with monomeric units of amino acids[1]. Peptides are biopolymers made-up of long chains of amino acids held together by amide bonds. They are a vital component of the human body and conduct a wide range of biological functions. Because both peptides and proteins are composed of amino acids, the body readily accepts peptides. Both peptide chemistry and nanotechnology are highly advanced and the relevant research fields are gaining widespread awareness nowadays. Today, research in these areas is of the utmost importance for the progress of sophisticated and efficient medication delivery mechanisms. Peptides are utilized as promising biomaterials for disease diagnostics[2]. Peptides can attach to specific targets, such as those present within cancers tissues, bones, muscles, and other human tissues. Due to their short plasma half-life and propensity to be proteolyzed and eliminated from the body[3], peptides have limited clinical applicability. As opposed to linear peptides, cyclic peptides are invulnerable to proteolytic degradation and have a longer half-life due to their more resilient molecular arrangement constraints[4]. As a result of their multiple properties, such as bi-