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One-Component Nanomedicine

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Abstract:

One-component nanomedicine (OCN) represents an emerging class of therapeutic nanostructures that contain only one type of chemical substance. This one-component feature allows for fine-tuning and optimization of the drug loading and physicochemical properties of nanomedicine in a precise manner through molecular engineering of the underlying building blocks. Using a precipitation procedure or effective molecular assembly strategies, molecularly crafted therapeutic agents (e.g. polymer-drug conjugates, small molecule prodrugs, or drug amphiphiles) could involuntarily aggregate, or self-assemble into nanoscale objects of well-defined sizes and shapes. Unlike traditional carrier-based nanomedicines that are inherently multicomponent systems, an OCN does not require the use of additional carriers and could itself possess desired physicochemical features for preferential accumulation at target sites. We review here recent progress in the molecular design, conjugation methods, and fabrication strategies of OCN, and analyze the opportunities that this emerging platform could open for the new and improved treatment of devastating diseases such as cancer.

1. Introduction

Using discrete nanostructures to deliver pharmaceutically active compounds offers possibilities for both improved treatment efficacy and reduced side effects. In this approach, water insoluble/sensitive drugs, when loaded within a nanocarrier, could be made to have increased *in vivo* solubility/stability, prolonged circulation time, and enhanced accumulation at disease sites. With the protection of the carrier, the loaded drugs are not expected to interface with the biological environments before their release to the surroundings of their molecular targets. It is the physicochemical properties of the carrier, rather than the molecular characteristics of the drug to be delivered, that determine the