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A Short Commentary of Nanotechnology on Traditional Chinese Medicine

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Abstract

Traditional Chinese medicines (TCM) have many bioactive ingredients or parts, but there are still some limitations for medical field application, such as solubility and absorptivity in the human body. Nanotechnology is an effective way to enhance its bioavailability. How do we incorporate traditional Chinese medicines (TCM) with nanotechnology? This short commentary discusses the background of nanotechnology and its research progress with TCM as well as the future aspects.

Introduction

Nanotechnology is the art of science manipulating matter at the nanoscale about 1 to 100 nanometers, 10^{-9} nm ranging from a sheet of paper (100,000 nanometers thick) to a human hair (around 80,000-100,000 nanometers). This is the study of small microscopic things such as nanomaterials including carbon-based, dendrimers, composites, and metal-based [1]. "Top-down" and "Bottom-up" are the nanoscale approaches for making nanomaterials (Table 1).

Traditional Chinese medicines (TCM) such as licorice, curcumin, celastrol, and astragalus have bioactive ingredients, bioactive parts, medicinal materials, or complex prescriptions which have lower solubility and bioavailability, especially in the absorption of a human body. These are processed by nanotechnology to reduce the adverse effects of TCM, achieve sustained release, attain targeted delivery, enhance pharmacological effects and improve the administration route of TCM [3].

Research Progress

Growing evidence has shown that nanotechnology was effective on the TCM to improve its bioavailability. Wu et al. reported an FA-Zein (core) combined with pectin (shell) to promote the bioavailability of glycyrrhizic acid (GA) on licorice and the anti-inflammatory effect in specific parts of the intestine [4]. Xie et al. developed poly(lactic-co-glycolic acid) nanoparticles of curcumin, "Cur-PLGA-NPs", for studying

Table 1: Nanoscale approaches [2].

Top-down	Bottom-up
Create smaller objects using larger objects	Arrange smaller components into more complex
Use principles of molecular recognition	Self-assembly

the effect and mechanisms on the oral bioavailability of curcumin. The relative bioavailability was 5.6-fold with a longer half-life compared to the native curcumin after oral administration of CUR-PLGA-NPs [5].

Law et al. designed a folic acid and gold nanoparticle (AuNP) conjugated with PVP-co-2-dimethylaminoethyl methacrylate (Polymer) and celastrol which improved the water solubility of celastrol and enhanced its anticancer activities against breast cancer [6]. Xiong et al. indicated the PEGylated PLGA nanoparticles encapsulating astragalus polysaccharides (APS) and gold nanorods (AuNRs) were constructed by a simple double emulsion method for the treatment of breast cancer which facilitated real-time imaging, promoted thermal ablation effects, and boosted FUS-induced immune effects [7].

Besides, nanotechnology also assists TCM in photodynamic therapy (PDT) against SARS-CoV-2 after improving its bioavailability, such as curcumin [8]; Curcumin-loaded nanocarriers for increasing their bioavailability and therapeutic efficiency, which is an antiviral agent for the treatment of SARS-CoV-2 [9].

Conclusion

The above information demonstrates that a nanotechnology is an alternative approach for enhancing the bioavailability of bioactive ingredients for TCM. However, much more works need to be done for TCM nanotechnology, particularly in the safety assessments of the clinical trials for human.

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Author Contributions

All authors contributed to the concept, acquisition and analysis of data, drafting of the article, and critical revision for important intellectual content.

Conflicts of Interest

The authors have no conflicts of interest to disclose.

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