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A New Avenue for Drug Delivery of Metal-Organic Frameworks

Dr. Jian-Qiang Liu*

Dongguan Key Laboratory of Drug Design and Formulation Technology, Key Laboratory of Research and Development of New Medical Materials of Guangdong Medical University and School of Pharmacy, Guangdong Medical University, Dongguan, China

***Corresponding Author:** Dr. Jian-Qiang Liu, Dongguan Key Laboratory of Drug Design and Formulation Technology, Key Laboratory of Research and Development of New Medical Materials of Guangdong Medical University and School of Pharmacy, Guangdong Medical University, Dongguan, China.

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Abstract

As is well-known, conventional anticancer agents or medicines exhibit poor evaluation in targeted delivery and give rise to toxicity in body with extended doses. Much efforts were made to explore various nanocarriers for targeted release of the chemotherapeutic medicines to cancer cells. The important issues with the existing drug carriers rests on their poor loading capacity or burst release of the drug. To address this issue, nanoscale metal-organic frameworks (NMOFs) possess unique properties desirable for delivery of drugs and gaseous therapeutics.

Keywords: *Nanoscale Metal-Organic Frameworks (NMOFs); Anticancer Agents; Drug Delivery Systems (DDSs)*

Different strategies have been developed to surmount limitations of traditional pharmacological avenues (e.g. biodegradation, low specificity, toxicity, side effects). Nanoparticulate metal-organic frameworks (NMOFs) with high storage capacities, tailorable functionalization and excellent biocompatibilities considered as promising carries in nanoscale drug delivery systems (DDSs) [1]. At the initial stage, there are plenty of studies and reviews that explored the use of NMOFs as DDSs, they often include a single active drug ingredient. Until now, lots of works were focused on the MOF bioplatforms that exhibit advanced combined therapies (such as photodynamic therapy (PDT), sonodynamic therapy (SDT), chemodynamic therapy (CDT) and controlled drug release (CDR)) [2]. These advanced therapy platforms could be divided into: a) the simultaneous encapsulation or sequential release of small drugs and macromolecules enzyme, b) highly efficient and targeted drug delivery the external triggered stimulus (such as near infrared-NIR and magnetic field), c) monitoring administration towards a bioimaging technology, d) integration of diagnosis and treatment by combining drug delivery and diagnosis, e) employment of biosensors of detection of different analytes [3-6]. All the promising and outstanding combined advanced therapies based on NMOFs bioplatforms offer the new approach and methodology for the development of more efficient diagnosis and treatments [7-10]. Nevertheless, NMOF-based DDS suffer a few drawbacks which require worthy of attention. These are: i) the cytotoxicity of the NMOF backbone; ii) instability of MOFs under physiological conditions; iii) difficulty of loading large-sized drugs owing to inadequate pore size and accessibility of the framework voids.

Conclusion

However, such DDSs still exist some drawbacks and should be addressed in the future. Firstly, degradation, stability and toxicity of NMOF should be considered as important issue in their design optimization. The second issue is that the installation of stimulus-responsive prototype onto the surface of NMOFs usually requires complicated synthetic steps. Therefore, the major technical difficulties

of nanosystem have led to the birth of key technologies and facilities which urgently needed in current clinical integration demand. The DDSs based on NMOFs are beginning to be mastered, underlining the young age of this research field but also leaving plenty of room for new creative insights.

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