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Short Communication

Porous Metal-Organic Nanocomposite Structure: An Emerging Nanocarrier for Application in Pharmaceutical and Biomedical Sciences

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Abstract

Metal-organic frameworks (MOFs) are a porous structure at nanoscale composed of metal ion linked with organic ligands is the recent advances in material chemistry intended for biomedical and pharmaceutical application. The main components of MOFs are novel biomaterial that should have physico-chemical compatibility in the biological system and has received great attention for potential applicability in bio-chemical sciences, nanotechnology and pharmaceutical system. The wide exploration of MOFs is due to excellent porosity, high payload, and encapsulation efficiency. There is a great scope of surface modification in the nanocomposite by various targeting ligands such antibodies, aptamer, protein, peptides, DNA RNA, and imaging agents etc. Despite of this favorable feature application of such as nanocomposite is however, limited due to low biodegradability, biocompatibility and safety and toxicity issues. Thence, scientist working in this arena trying to engineer such a valuable nanocarrier for wide spread application in multidisciplinary area along with minimizing their nanotoxicity, improving biocompatibility and biodegradability characteristics.

Keywords: Metal-organic Frameworks (MOFs); Nanocarrier

Introduction

The metal organic framework nowadays has been widely searched nanomaterials owing to their sincere application in material science, nanotechnology, biomedical sciences and pharmaceutical drug delivery. The wide spread acceptability of these material is due to the characteristics of surface tunable, modification, ligation, improved rate of drug permeation, optimum nanocarrier size, biostability, better in vitro and in vivo performances. MOFs are co-ordination complex structure in which therapeutics remains embedded in the hexagons, cubic, and other molecular geometry of compound along with other molecules such as biosensor, imaging agent, or chemical marker agents. However, the nanotoxicity due to presence of certain metal in co-ordination complex structure as well as the biodegradability is the prime concern which needs to further addressed in the scientific community.

Surface alteration MOFs

The surface alteration of nanocarrier make them ideal for targeted drug delivery in tumor cells. It improves aqueous solubility, stability, payload, and prevent uptake by the mononuclear phagocytic system thereby reducing drug dose, frequency of dose, drug induced side effect, and improving patient compliance.

Nanoscale application of MOFs

In drug delivery application, MOFs is the recent interest for encapsulating active moiety within the framework for site specific targeting. Iron-loaded BioMIL-1 MOFs exhibited significant loading of nicotinic acid up for controlled drug delivery. It is utilized for specific delivery of macromolecules such as plasmid, DNA, gene, SiRNA etc. The ferric oxide MOFs containing Doxorubicin has demonstrated superior cytotoxicity in Hela cells. Beside these, it is used as antiseptic, disinfectant, and as biosensor. The stability of MOFs has been estimated in buffered saline media and evaluated for their degradation profile and further indicated it depends on the physical state, composition and particle size of MOFs [1-6].

Conclusion

A breakthrough in nano MOFs finds a novel way and requires further investigation (preclinical and clinical) in biological system to warrant potential applicability in biomedical and pharmaceutical field

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