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Functional metal–organic framework-based nanocarriers for accurate magnetic resonance imaging and effective eradication of breast tumor and lung metastasis

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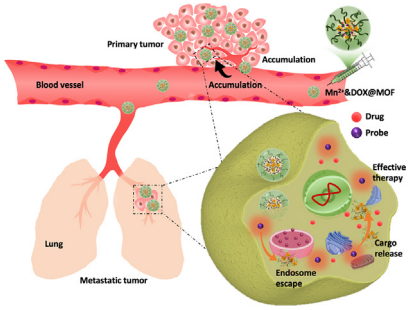
GRAPHICAL ABSTRACT



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ABSTRACT

The use of nanoscale metal–organic frameworks (MOFs) as drug delivery vehicles has attracted considerable attention in tumor therapy. In this study, novel biocompatible MOF-based nanocarriers were used as part of a facile and reproducible strategy for precision cancer theranostics. Both diagnostic (Mn^{2+}) and therapeutic compounds (doxorubicin, DOX) were incorporated into the multifunctional MOF-based nanocarriers, which exhibited high colloidal stability and promoted T_1-weighted proton relaxivity and low-pH-activated drug release. The obtained MOF-based nanocarriers exhibited significantly high cellular uptake and efficient intracellular drug delivery into cancer cells, which resulted in high apoptosis and cytotoxicity, in addition to effectively inhibiting the migration of 4T1 breast cancer cells. Moreover, the MOF-based nanocarriers could intensively deliver diagnostic and therapeutic agents to tumors to enable precise visualization of the nanocarrier accumulation and accurate tumor positioning, diagnosis, and imaging-guided therapy using magnetic resonance imaging (MRI). In addition, the functional MOF-based nanocarriers exhibited effective ablation of the primary breast cancer, as well as significant inhibition of lung metastasis with a high survival rate. Therefore, the developed nanocarriers represent a viable platform for cancer theranostics.

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1. Introduction

The engineering of nanoscale drug delivery systems (*i.e.*, nanocarriers) has been demonstrated to have great potential in

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