Chemical Research in Toxicology

Article

Cite This: Chem. Res. Toxicol. 2019, 32, 1599−1618

pubs.acs.org/crt

MoS_2-Modified Curcumin Nanostructures: The Novel Theranostic Hybrid Having Potent Antibacterial and Antibiofilm Activities against Multidrug-Resistant Hypervirulent *Klebsiella pneumoniae*

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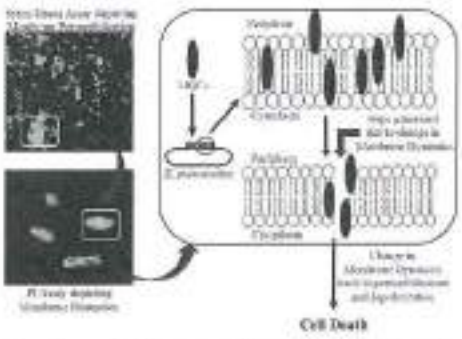
Supporting Information

ABSTRACT: The recent emergence of hypervirulent clinical variants of *Klebsiella pneumoniae* (hvKP) causing community-acquired, invasive, metastatic, life-threatening infections of lungs, pleura, prostate, bones, joints, kidneys, spleen, muscles, soft-tissues, skin, eyes, central nervous system (CNS) including extrahepatic abscesses, and primary bacteremia even in healthy individuals has posed stern challenges before the existing treatment modalities. There is therefore an urgent need to look for specific and effective therapeutic alternatives against the said bacterial infection or recurrence. A new type of MoS_2-modified curcumin nanostructure has been developed and evaluated as a potential alternative for the treatment of multidrug-resistant isolates. The curcumin quantum particles have been fabricated with MoS_2 via a seed-mediated hydrothermal method, and the resulting MoS_2-modified curcumin nanostructures (MQCs) have been subsequently tested for their antibacterial and antibiofilm properties against hypervirulent multidrug-resistant *Klebsiella pneumoniae* isolates. In the present study, we found MQCs inhibiting the bacterial growth at a minimal concentration of 0.0156 μg/mL, while complete inhibition of bacterial growth was evinced at concentration 0.125 μg/mL. Besides, we also investigated their biocompatibility both *in vitro* and *in vivo*. MQCs were found to be nontoxic to the SiHa cells at a dose as high as 1024 μg/mL on the basis of the tested adhesion, spreading of the cells, and also on the various serological, biochemical, and histological investigations of the vital organs and blood of the Charles Foster Rat. These results suggest that MQCs have potent antimicrobial activities against hvKP and other drug resistant isolates and therefore may be used as broad spectrum antibacterial and antibiofilm agents.



1. INTRODUCTION

The last two decades have witnessed the emergence of hypervirulent *Klebsiella pneumoniae* (hvKP), a new clinical variant.[1] Unlike the "classical" *K. pneumoniae* (cKP), it causes community-acquired pyogenic liver abscess (CAPLA) and intriguingly causes septic metastatic spread to distant sites in the majority of cases (as high as 80% of cases). Although hvKP infect(s) all races, the majority of cases have been reported among Asians exhibiting a very high mortality ranging from 3−42%.[2] The situation becomes more intricate with survivors of metastatic spread leading to the manifestation of ruinous morbidities such as loss of vision and neurologic sequelae. Metastatic spread is a common feature among Gram-positive pathogens such as *Staphylococci* and *Streptococci* but is uncommon among enteric Gram-negative pathogens.[3] From a clinical perspective, hvKP management becomes more important due to its associated high morbidity and mortality among healthy individuals. The detection of hvKP is somewhat

Received: March 29, 2019
Published: July 18, 2019

DOI: 10.1021/acs.chemrestox.9b00133
Chem. Res. Toxicol. 2019, 32, 1599−1618

self attested