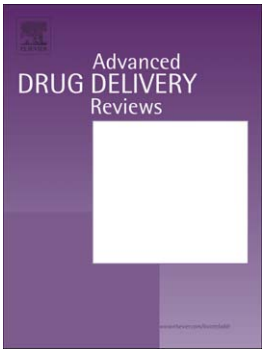

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Weiwei Gao, Yijie Chen, Yue Zhang, Qiangzhe Zhang, Liangfang Zhang

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Nanoparticle-Based Local Antimicrobial Drug Delivery

Weiwei Gao, Yijie Chen, Yue Zhang, Qiangzhe Zhang, Liangfang Zhang*

Department of Nanoengineering and Moores Cancer Center, University of California, San Diego, La Jolla, CA 92093, USA

*Corresponding author: Tel: 858-246-0999, Email: zhang@ucsd.edu

Abstract

Despite the wide success of antibiotics in modern medicine, the treatment of bacterial infections still faces critical challenges, especially due to the rapid emergence of antibiotic resistance. As a result, local antimicrobial treatment aimed at enhancing drug concentration at the site of infection while avoiding systemic exposure is becoming increasingly attractive, as it may alleviate resistance development. Meanwhile, therapeutic nanoparticles, especially liposomes, polymeric nanoparticles, dendrimers, and inorganic nanoparticles, are gaining traction to improve the therapeutic efficacy with many applications specifically focused on local antimicrobial treatment. This review highlights topics where nanoparticle-based strategies hold significant potential to advance treatment against local bacterial infections, including (1) promoting antibiotic localization to the pathogen, (2) modulating drug-pathogen interaction against antibiotic resistance, and (3) enabling novel anti-virulence approaches for 'drug-free' antimicrobial activity. In each area, we highlight the innovative antimicrobial strategies tailored for local applications and review the progress made for the treatment of bacterial infections.

Keyword

Nanomedicine, nanoparticle, bacterial infection, antimicrobial treatment, local delivery