Nanotechnology, Science and Applications

Dovepress
Taylor & Francis Group

Open Access Full Text Article

LETTER

The Substantial Role of Cell and NanoparticleSurface Properties in the Antibacterial Potential of Spherical Silver Nanoparticles [Letter]

Danfeng Shen

Department of General Surgery, Taicang Affiliated Hospital of Soochow University, Suzhou, 215400, People's Republic of China

Correspondence: Danfeng Shen, Email danfengsh@hotmail.com

Dear editor

I am delighted to express my interest in the work published in Nanotechnology, Science and Applications regarding the relationship between nanoparticle charge and antimicrobial effect.[1] These findings challenged the existing views on the antibacterial mechanisms of silver nanoparticles (AgNPs) and their interactions with bacterial cells.

AgNPs have long been regarded as broad-spectrum bactericidal agents.[2,3] However, the relationship between nanoparticle properties, such as size and shape, and their antibacterial efficacy is rather intricate. The antibacterial effect of AgNPs depends not only on their inherent characteristics but also on the resistance levels of diverse bacteria. The authors themselves reported that there is a difference in the susceptibility of Gram-positive bacteria and most Gram-negative bacteria to AgNPs carrying either a highly negative or positive charge. Their findings were similar to a published work about a Gram-selective antibacterial based on charge-tunable modified MoS_2.[4] Niu et al reported that the citraconic anhydride-modified PEI-MoS_2, which carry a negative charge, exhibited stronger bactericidal properties Gram-positive bacteria, *S. aureus*, when compared with PEI (positive charge) modified nanoparticles.

I would like to mention the importance of lipophilic groups. They can interact with the lipophilic parts of the phospholipid bilayer of cell membranes, affecting the composition and structure of the membranes, transmembrane transport of substances, and the permeability and fluidity of cell membranes. Krychowiak-Maśnicka et al used AgNPs coated with sodium citrate as a highly negatively charged nanoparticles.[1] However, compared the other four modified AgNPs, AgNPs-Cit seems lack of lipophilic groups (or perhaps more details about this nanomaterial should be provided), which may result in a relatively low bactericidal ability. Instead, well-designed compounds like the citraconic anhydride-modified PEI-MoS_2 mentioned above should be employed.[4]

And according to literatures such as references 14–20 they cited in this article, I think the conclusion that moderate charge of silver nanoparticles is crucial for their bactericidal performance requires more evidence to support.

Disclosure

The author reports no conflicts of interest in this communication.

References

1. Krychowiak-Maśnicka M, Wojciechowska WP, Bogaj K, et al. The Substantial Role of Cell and Nanoparticle Surface Properties in the Antibacterial Potential of Spherical Silver Nanoparticles. *Nanotech Sci Appl*. 2024;17:227–246. doi:10.2147/NSA.S489407
2. Lara HH, Garza-Treviño EN, Ixtepan-Turrent L, Singh DK. Silver nanoparticles are broad-spectrum bactericidal and virucidal compounds. *J Nanobiotechnol*. 2011;9:30. doi:10.1186/1477-3155-9-30
3. Wang S, Bai J, Li C, Zhang J. Functionalization of electrospun β-cyclodextrin/polyacrylonitrile (PAN) with silver nanoparticles: broad-spectrum antibacterial property. *Appl Surf Sci*. 2012;261:499–503. doi:10.1016/j.apsusc.2012.08.044
4. Niu J, Sun Y, Wang F, Zhao C, Ren J, Qu X. Photomodulated Nanozyme Used for a Gram-Selective Antimicrobial. *Chem Mater*. 2018;30:7027–7033. doi:10.1021/acs.chemmater.8b02365

Received: 24 December 2024
Accepted: 17 January 2025
Published: 20 January 2025

https://doi.org/10.2147/NSA.S514191