DOI: https://doi.org/10.54393/pbmj.v5i12.837

PAKISTAN BIOMEDICAL JOURNAL

https://www.pakistanbmj.com/journal/index.php/pbmj/index

Volume 5, Issue 12 (Decemeber 2022)

Nanoparticles in the Era of Antimicrobial Resistance

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ARTICLE INFO

How to Cite:

Jawad Ahmad, F. . (2022). Nanoparticles in the Era of Antimicrobial Resistance. Pakistan BioMedical Journal, 5(12). https://doi.org/10.54393/pbmj.v5i12.837

Antimicrobial resistance is currently a global crisis and is becoming a major issue for human health. The pharmaceutical industries' efforts to create novel therapeutic choices are being slowed down by the active bacterial resistance to traditional antibiotics. Consequently, the rise in infectious diseases caused by resistant bacteria is accompanied by two main issues. Firstly, there is a rise in antibiotic resistance. Secondly, there is a growing disparity between the discovery of new drugs and the rise in antimicrobial resistance. Different treatment strategies are now being in practice to treat bacterial infections, including targeting bacterial virulence factors, bacteriophage therapy, and alteration of the microbiome. Alternative therapeutic approaches are consequently receiving more consideration as traditional antibiotics grow less effective [1]. The use of nanoparticles is one of the most promising ways for combating microbial drug resistance. Nitric oxide-releasing nanoparticles (NO NPs), chitosan-containing nanoparticles (chitosan NPs), and metal-containing nanoparticles are a few examples of nanoparticle types that use various ways to simultaneously fight against microorganisms. Nanoparticles can be used to overcome existing drug resistance mechanisms such as decreased drug absorption and increased drug efflux from the microbial cell, biofilm formation, and intrinsic resistance. Finally, antimicrobial drugs can be directed via nanoparticles to the site of infection, enabling greater therapeutic doses to be administered there and overcoming resistance. Antibodies directed against a specific antigen on the surface of the target microorganism can be coupled with nanoparticles. For instance, *S. aureus* can be killed with great specificity using nanoparticles linked with protein A antibodies [2]. Nanoparticles' chemical structure enables longer binding, active targeting of antibiotics with surface functionalization at the target location, and defense against enzymes. As a result, reaching a larger antibiotic concentration in the cell eliminates the need for a higher dose, which reduces adverse effects. Antibiotic nanoparticle conjugates have been recognized by several scientists as a novel class of antibacterial drugs that can lessen the issue of multidrug resistance. Numerous nanoparticles with antimicrobial properties, such as silver, gold, zinc oxide, and titanium oxide, have been tested against microbial pathogens that are multidrug-resistant in conjunction with commercially available antibiotics or peptides [3]. Widespread of infectious diseases caused by multiple resistant bacteria is increased day by day and pose a major threat to public health. Therefore, novel antimicrobial strategies are needed to combat the antimicrobial resistance. To reduce adverse effects, nanoparticles may be a preferable option for treating bacterial infections at very low concentrations.

REFERENCES

[1] Haq FU, Imran M, Saleem S, Aftab U, Ghazal A. Investigation of Morchella esculenta and Morchella conica for their antibacterial potential against methicillin-susceptible Staphylococcus aureus, methicillin-resistant Staphylococcus aureus and Streptococcus pyogenes. Archives of Microbiology. 2022 Jul; 204(7):1-3. doi: 10.1007/s00203-022-03003-8

[2] Pelgrift RY and Friedman AJ. Nanotechnology as a therapeutic tool to combat microbial resistance. Advanced drug delivery reviews. 2013 Nov; 65(13-14):1803-15. doi: 10.1016/j.addr.2013.07.011

[3] Jelinkova P, Mazumdar A, Sur VP, Kociova S, Dolezelikova K, Jimenez AM, *et al*. Nanoparticle-drug conjugates treating bacterial infections. Journal of controlled Release. 2019 Aug; 307:166-85. doi: 10.1016/j.jconrel.2019.06.013