



Review: Nanotechnology Revolution in confronting the Extreme-drug resistance (XDR) microorganisms

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SHORT SUMMARY

Technologies to combat antimicrobial, as well as extreme drug, resistance, based on nanotechnologies are reviewed. Special attention for micro and nano-emulsions due to their long-term stability.

EXTENDED ABSTRACT

Microbes with high levels of antimicrobial resistance (AMR), which are defined as extreme drug resistance (XDR), have become one of the most pressing threats to public health, gravely jeopardizing efforts to prevent and treat chronic diseases. Despite several steps taken in recent decades to address this issue, the patterns of worldwide AMR show no evidence of a real solution. The abuse and misuse of numerous antibacterial drugs in both the medical and agricultural fields has led to the emergence of antimicrobial resistance. Bacterial mutation, spontaneous evolution, horizontal gene transfer, and biofilm formation are further significant contributors to the development of antibiotic resistance.

The distinctive properties of nanotechnology have resulted in significant advances in all fields of industry and medicine. The novel physical and chemical properties of nanomaterials, allowing manipulating materials at atomic and molecular sizes, have resulted in shrinking the size of materials to Nano-range. That introduces and explains the nanotechnology significance and influences on many phenomena. AMR bacteria and genes are eliminated and destroyed because of the employment of novel nanomaterial attributes and the application of nanotechnology in XDR treatment.

A variety of volatile molecules are mixed together to form natural essential plant oils. They are extremely sensitive to environmental factors and

have a wide range of applications. Encapsulation and packaging films technology could improve the stability of essential oils.

Micro-emulsions and Nano-emulsions are isotropic, thermodynamically stable, and transparent (or translucent) oil, water, and surfactant systems with droplet sizes within Nano-range. Micro- and Nano-emulsions are potential antibacterial agents as well as drug delivery tools due to their long-term stability, ease of preparation (spontaneous emulsification), and high solubilization of drug molecules.