Cleveland Clinic Innovations

PRODUCT
Antimicrobial Nanocomposites

INDICATION
Antimicrobial Resistance

VALUE PROPOSITION
Nanocomposites as anti-microbial agents for biomedical applications

DEVELOPMENT STAGE
Proof of concept validation

INTELLECTUAL PROPERTY
Issued Patent (US, UK, EU)
US Patent 16/483,096

RELATED PUBLICATIONS
Palomino, Luis et al. "Polyhydroxy Fullerenes Enhance Antibacterial and Electrocatalytic Activity of Silver Nanoparticles." Nanomaterials vol. 12,19 3321.

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Novel Nanocomposites as Antimicrobial Agent

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OPPORTUNITY

The quest for innovative antimicrobial solutions is constantly challenged by anti-microbial resistance. In this context, metal compounds, notably silver, have shown promise in medical device coatings due to their inherent antibacterial properties. Overcoming challenges associated with silver nitrate, such as toxicity and skin discoloration, requires alternative approaches. Recent research highlights the catalytic potential of metal nanoparticles, especially gold nanoclusters, in microbial eradication. This novel avenue addresses the limitations of low quantum efficiency observed in previous metal nanoparticle studies. Additionally, the incorporation of metal nanoparticles into antimicrobial polymers, along with the optimization of their electronic properties for diverse applications like solar cells and biosensors, represents a dynamic and multifaceted opportunity to revolutionize antimicrobial strategies. This approach offers a comprehensive pathway to effectively combat microbial resistance in various settings.

SOLUTION

Cleveland Clinic researchers have developed nanocomposites that incorporate metal nanoparticles and functionalized fullerenes, specifically polyhydroxy fullerenes (PHF), which are water-soluble derivatives. Fullerenes are spherical carbon cages made of carbon atoms. The metal nanoparticles, encompassing gold, silver, copper, platinum, iron, or palladium, exhibit notable catalytic activity within the metal-fullerene nanocomposites, generating free radicals thereby effective in microbial eradication. Antibacterial assays using *E. coli* showed enhanced antimicrobial activity for PHF-AgNPs compared to citrate-AgNPs (Fig 1).

In conclusion, PHF can be used as a single reducing and capping agent, andPHF enhances the antibacterial properties of metallic nanoparticles, thereby opening up the possibility for biomedical applications.

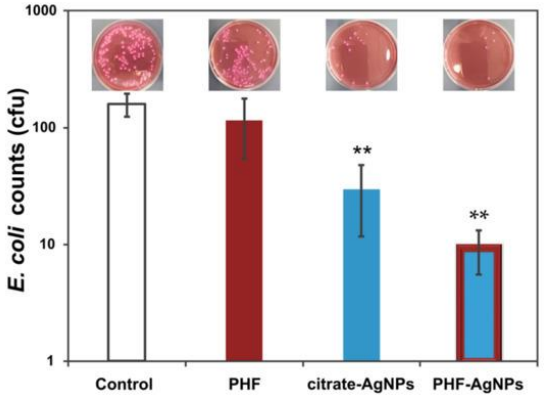

Fig 1. Examples of colony-forming units of *E. coli* in agar plates untreated (control) and treated with PHF, citrate-AgNPs, and PHF-AgNPs, after 24 h of culture.