Nanoantimicrobials. State of the art and new perspectives

Nicola Cioffi, Rosaria Anna Picca

Department of Chemistry, University of Bari Aldo Moro, Bari, Italy
CSGI (Center for Colloid and Surface Science) Bari Unit, University of Bari Aldo Moro, Bari, Italy

In 2012, the term "Nanoantimicrobials" (NAMs) appeared for the first time in the title of one of the most diffused textbooks in the field of antimicrobial nanomaterials.[1] Since then, the number of papers combining the keywords "nano" and "antimicrobial" has progressively increased (Fig. 1); the vast majority of this scientific production being focused on the development of nanomaterials with enhanced nanoparticle properties, and/or antibacterial functionalities.

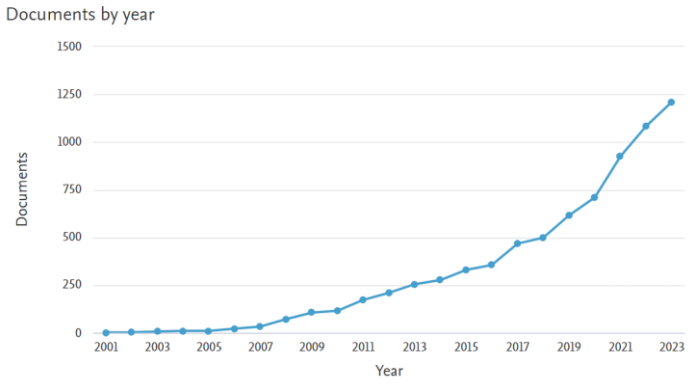

Fig. 1. Publication trends in the field of nanoantimicrobials. Source Scopus® database, searched on Jan 12th, 2024, with the keywords "nano", "antimicrobial"; time interval: 2001-2023; distribution shows about 7500 documents

After the outbreak of the severe acute respiratory syndrome coronavirus (SARS-CoV-2), several groups working on NAMs re-oriented their activities towards the development of antivirals [2]. This has not been the first, nor the last pandemic, as subsequently demonstrated by the additional outbreak of the monkeypox virus.
Microbial infections are a major issue worldwide. Among them, healthcare- and food-related infections are the most abundant ones. They are frequently associated to the occurrence of biofilms and or AntiMicrobial Resistance (AMR) phenomena. Biofilms have the ability to tolerate antibiotics, host defense systems and other external stresses. [3] AM resistant bacterial strains are able to resist antimicrobial treatments, especially antibiotics, and have a direct impact on human and animal health, along with a great economic impact.[4]
The nanomaterials community is offering several technological solutions to challenge the ongoing and future global health emergencies. Most of the proposed materials are proven to be highly effective in the removal of individual biothreats, including virus, antibiotic-resistant bacterial strains, biofilms of industrial and biomedical concern.

However, an increasing concern is being raised about (nano)safety The question is how our research on antimicrobial agents may match the increasing demand for green and chemically safe technologies: do we really investigate nanotechnologies that will help us to solve the future biothreats?

Our most recent experimental efforts are being devoted to the development of green and scalable routes to broad spectrum antimicrobials with *non-nano characteristics:* bulk metal alloys, ionic exchangers, coordination polymers, submicron particles, intrinsically insoluble salts, biomass-related organic active components, etc. This presentation will offer an overview of these alternative compounds and materials, proposed as non-conventional tools for the fight against biothreats.
Some key aspects of the roadmap to novel and enhanced (non-nano-)antimicrobials of industrial value will be concisely mentioned, with focus on food-packaging applications.

References:
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