Nano Zeolite-Y: A Novel and Cost-Effective Antibacterial Composition

A novel and cost-effective inorganic antibacterial composition.

Technology

This invention pertains to the composition and production of a new zeolite composition, termed nano zeolite-Y, that exhibits intrinsic antibacterial activity. Nano zeolite-Y is produced through a novel ball milling approach using zeolite microparticles and found to retain the fundamental zeolite framework (faujasite framework). In unpublished proof-of-concept (PoC) studies, the inventors found that nano zeolite-Y disks can both inhibit and kill a clinically-relevant E.coli strain as demonstrated by disk diffusion assays, cell adhesion experiments, and confocal microscopy. These data suggest that nano zeolite-Y possesses inherent antibacterial activity against gram-negative bacteria and could be applied as a next-generation antibacterial composition.

Background

Resistance by microorganisms to antibiotics and/or disinfectants is a global threat to public health. Such resistance leads to worse patient outcomes and higher risks of disease transmissibility, which in turn, results in greater healthcare costs. Given the limited efficacy of current antibiotics, there is an urgent and unmet need for the development of novel materials with bacteriostatic and bactericidal properties. Inorganic materials are particularly promising candidates due to their chemical stability, high thermal resistance, and longer half-life.

Zeolites are a class of inorganic compounds composed of crystalline aluminosilicates with well-ordered microporous structures. Zeolite nanoparticles are currently widely adopted as ion-exchangers in desalination, wastewater and soil treatment, and also as catalysts for hydrocarbon cracking. However, zeolites do not possess inherent antibacterial properties; to gain such activity, antibacterial metals (such as Zn, Ag, and Cu) are often exchanged into the compound. Therefore, the development of next-generation zeolite compositions with intrinsic antibacterial activity would be a major technological advancement and could afford numerous cost-effective commercial applications.

Applications

Category

Life Sciences/Therapeutics/Antibacter

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- Healthcare/medical products:
  - Materials for medical devices
  - Coatings for hospital surfaces
  - Delivery vectors for therapeutics
- Industrial and environmental products:
  - Molecular sieves for water filtration, soil and air purifiers
  - Filtration membranes
- Consumer products:
  - Textiles
  - Food packaging
  - Cosmetics

Advantages

- Inherent antibacterial properties: Nano zeolite-Y does not require ancillary antibacterial metals (Zn, Ag, Cu) for antibacterial activity
- Classified as GRAS (generally regarded as safe) by the FDA: Zeolites are currently used in dietary supplements, tissue engineering, wound healing, and drug delivery
- Advantageous physical and chemical characteristics: Favorable chemical stability, high thermal resistance, and environmentally safe
- Low-cost material: Zeolites are relatively low-cost materials
- Broad applicability: The chemical and physical properties of zeolites provide tailorability to numerous applications

IP Status

Provisional patent application pending