TECH OFFER

Copper Nanoparticle Antimicrobial Coatings

KEY INFORMATION

TECHNOLOGY CATEGORY:
Chemicals - Bio
Materials - Nano Materials

TECHNOLOGY READINESS LEVEL (TRL): TRL6
COUNTRY: SINGAPORE
ID NUMBER: TO174603

OVERVIEW

Disease prevention through intervention by antimicrobial coatings in our surroundings can bring huge economic and social benefits, primarily due to reduced hospitalisation rates, decreased medical bills associated with medication, less psychological distress among the sick and their carers, etc. Although the current disinfectant technology is effective in preventing the spread of infectious pathogens via surface sanitisation, it still suffers from poor durability and requires regular daily applications to keep a high antibacterial activity.

This versatile formulation technology not only endows surfaces with anti-wetting features, but also imparts fast, potent, robust, and long-lasting antibacterial properties, which can be applied to both soft and hard surfaces through chemical bonding.

The technology's competitive edge is mainly derived from the use of copper nanoparticles instead of the easy-to-wash-off organic disinfectants that require multiple and periodic applications. Relying on a contact-killing mechanism, a close to 100% bacterial killing efficiency within 45 seconds against hypervirulent Klebsiella pneumoniae, one of the major pathogens causing

pneumonia, has been shown. In addition, the formulation can be engineered to coat upholstery and textile materials and on a variety of surfaces, such as plastic, wood, etc., thus providing a more ubiquitous protection against bacterial – and possibly viral – infections.

TECHNOLOGY FEATURES & SPECIFICATIONS

- Rapid killing of 99% of bacteria including Gram-positive and Gram-negative bacteria (e.g. Klebsiella pneumoniae, Staphylococcus aureus, Pseudomonas aeruginosa) within 45 seconds
- Continuous, sustained, and long-lasting antibacterial activity enabled by reactive oxygen species generation resulting in high oxidative stress damage on bacteria
- Endows surfaces with anti-wetting, self-sanitising, and self-disinfectant features
- Formulated with reduced quantities of active material (0.08 – 0.10 wt%) within minimum material waste
- The nanosized feature enables high surface reactivity even at very small loading of the active material
- Versatile formulation that can be applied onto natural or synthetic materials (e.g. wood, paper, polymer), porous or continuous, soft or hard surfaces
- Conformal coating formulation that does not compromise the inherent properties of the substrate material (e.g. breathability, rigidity, structural stability)
- Adaptable and hassle-free application method using dip-coating process or spray-coating process

POTENTIAL APPLICATIONS

The technology can be adopted by potential partners in the field who would like to introduce additional antibacterial features in their existing products. The researchers will explore how to translate their current formulation to suit the intended applications.

This formulation can be coated on:

- Natural and synthetic fabric materials (e.g. clothing, face masks, bed linen)
- Upholstery materials (e.g. office chairs and carpet flooring)
- Air conditioning and air filtration and ventilation materials at home, office, aircraft
- High touch surfaces (e.g. handrails, doorknobs, lift panels)
- Walls of high-risk infection places (e.g. hospitals, clinics, quarantine facilities)

The technology is applicable to, but not limited to, the following areas and markets:

- Personal protective equipment and antimicrobial clothing
- Indoor air quality management system
- Medical and healthcare
- Building and construction (e.g. mould remediation)

This technology contributes to the projected growth of the global antibacterial coatings market at a CAGR of 13.1% from 2021 to 2028.

UNIQUE VALUE PROPOSITION

- The use of nanosized particles enables the realisation of highly bacterial killing surfaces while using reduced amounts of active material

- Excellent bacterial killing properties against a broad range of pathogens within 45 seconds
- Chemical bonding between the coating and the substrate allows to create an antibacterial surface that remains active for an extended period of time
- The formulation can be coated on materials with distinct surface chemistry
- Copper is abundant and generally cost-effective, and the synthetic routes of the nanoparticles have been established and are readily available, thus making this technology economically viable
- Application methods based on mature technology such as dip coating and spray coating are inherently cost saving