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TECH OFFER

Enhanced Antimicrobial Properties of Polymer Products with Silver Nanoparticles

KEY INFORMATION

TECHNOLOGY CATEGORY:
Materials - Plastics & Elastomers
Chemicals - Polymers
Chemicals - Additives
Manufacturing - Chemical Processes
Environment, Clean Air & Water - Sanitisation

TECHNOLOGY READINESS LEVEL (TRL): TRL9
COUNTRY: JAPAN
ID NUMBER: TO175502

OVERVIEW

Antimicrobial plastic products are in increasing demand across healthcare, consumer products, and industrial sectors to reduce the spread of harmful microbes while maintaining material performance. However, conventional antimicrobial additives often rely on pre-formed nanoparticles, which are prone to aggregation and can complicate handling and processing, particularly in thin films, fibres, and transparent components.

This technology enables the in-process formation and uniform dispersion of silver (Ag) nanoparticles within thermoplastic resins during standard polymer processing, such as extrusion and injection moulding. By incorporating silver fatty acid salts into the resin formulation, nanosized silver particles are generated during thermal processing and stabilised within the polymer matrix, ensuring consistent dispersion under typical shear and thermal conditions. The resulting silver nanoparticles, with sizes on the

order of several tens of nanometres, deliver reliable antimicrobial performance at very low additive loadings (as low as 0.01 wt%), while preserving optical clarity and mechanical properties. Accordingly, this technology is particularly well suited for incorporating antimicrobial agents into thin films and fibres, where optical clarity and defect-free moulding are critical. When used in fibres, it helps prevent filament breakage during melt spinning. A resin-compounded antimicrobial masterbatch based on this technology has already been commercialised in products such as face masks and waste bags, demonstrating scalability and real-world applicability.

The technology owner is seeking test bedding and pilot deployment partners in resin processing, polymer manufacturing, and end-product sectors to validate performance, scale production, ensure regulatory compliance, and expand application portfolios. In parallel, dispersion methods for solvent-based systems are under development, and partners in surface coatings and film manufacturing are welcomed for co-development and scale-up opportunities.

TECHNOLOGY FEATURES & SPECIFICATIONS

This technology enables in-process formation and dispersion of silver nanoparticles within thermoplastic resin, such as polypropylene (PP), polyethylene (PE) and polystyrene (PS), ensuring consistent antimicrobial efficacy without compromising processability and final product quality in terms of transparency and mechanical performance.

Key technical features include:

- **Nanoparticle size:** several tens of nanometres, enabling preservation of material properties
- **Low active silver loading:** effective at ~0.01 wt% without performance loss
- **Antibacterial performance:** verified in accordance with ISO 20743 and 22196, effective against a broad spectrum of bacteria, including both Gram-positive and Gram-negative species (e.g., Staphylococcus aureus and Escherichia coli)
- **Process compatibility:** compatible with standard extrusion and injection moulding processes
- **Optical clarity:** high transparency retained even in thin films and fibres, without haze or whitening
- **Safety validation:** confirmed through acute oral toxicity, skin irritation, mutagenicity, and skin sensitisation tests
- **Adaptability:** available as an antimicrobial masterbatch with industrial supply capability; solvent-based dispersions under development for coating applications

POTENTIAL APPLICATIONS

This technology enables antimicrobial functionality across a wide range of polymer-based products and multiple industries, including but not limited to:

- **Hygiene & Personal Care:** antibacterial seals, labels, hygiene items
- **Home Care & Household Goods:** garbage bags, antibacterial packaging, kitchen products
- **Textiles & Apparel:** masks, underwear, towels, sheets, medical linens, gowns
- **Healthcare & Medical:** medical gowns, bed linens, instrument covers, antimicrobial components
- **Commercial & Institutional Coatings:** high-touch surfaces such as handrails and doorknobs
- **Consumer Electronics & Accessories:** phone cases, remotes, keyboards
- **Building Materials & Interiors:** panels, wall and floor coverings, furniture surfaces
- **Industrial Applications:** antibacterial packaging, workwear, industrial components

The technology is particularly suitable for moulded parts, thin films and coated surfaces where both antimicrobial performance and visual quality are critical.

UNIQUE VALUE PROPOSITION

- Achieve high antimicrobial efficacy with very low silver content, reducing material usage and cost while maintaining consistent performance
- In-process formation of silver nanoparticle ensures uniform dispersion, preserving transparency and mechanical integrity
- Integrate seamlessly into polymer processing workflows, eliminating nanoparticle handling and reducing operational complexity, safety risks, and regulatory burden
- Masterbatch format enables easy, reproducible and industrial-scale deployment without major equipment modifications