Biotech Consortium India Limited

Green- compounding technology for production of antibacterial polymer nanocomposites

TECHNOLOGY AVAILABLE FOR TRANSFER

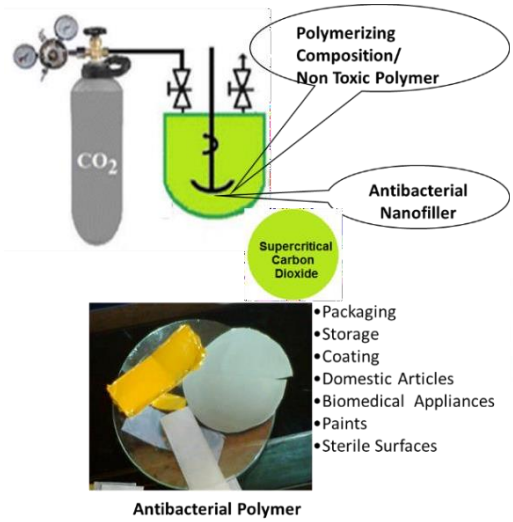
UNMET NEED AND OPPUURTUNITY

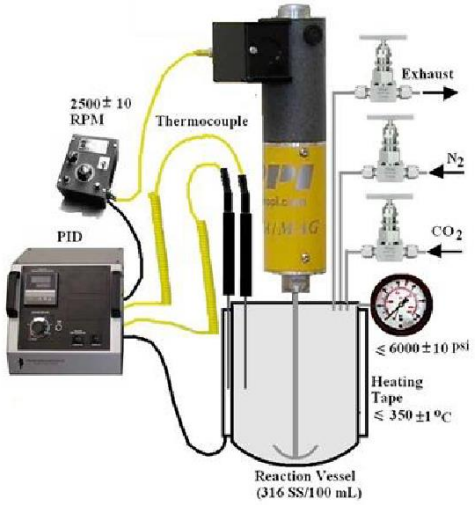
Industrial polymers are susceptible to bacteria and fungi - often leading to a potential loss of polymers. The use of polymers is wide ranging in several industries most common being plastics, paints, nylon etc. With the rising infections arising from hospitals, the bacterial protection becomes most apparent in healthcare sector for creating clean surfaces. Phone covers, light switches, food containers, reusable plastic bags can all benefit from better hygiene and protection against bacteria.

The incorporation of additives into polymers currently require volatile organic solvents and high energy inputs during manufacturing process.This leads to high cost, residual contamination, multi-step purification process, large area requirement, excessive processing time and temperatures andstringent environmental controlsfor disposal of volatile organic solvents. The use of supercritical fluids is often highlighted as viable strategy to replace volatile organic solvents, reduce energy inputs as compared to existing compounding methods thus enabling green technologies and provides a homogenous dispersion of nanofillers into polymers.

TECHNOLOGY

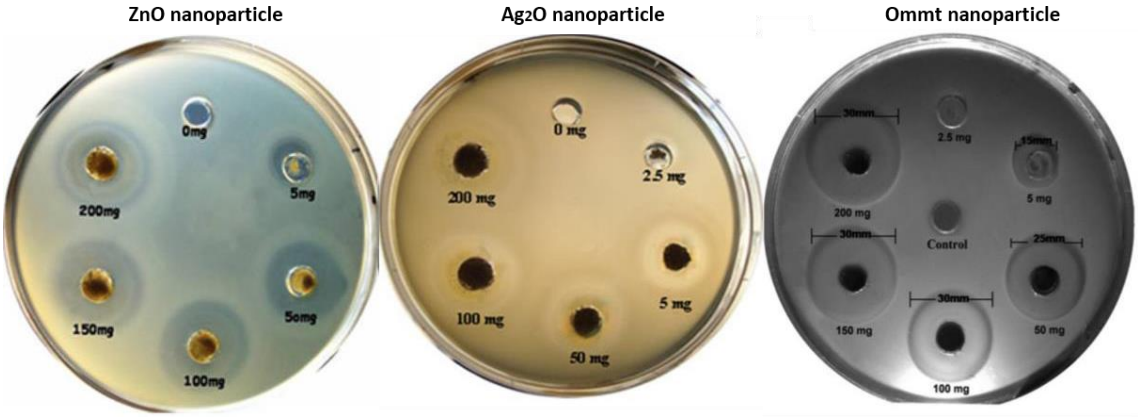
The current technology is regarding the use of supercritical fluids, particularly supercritical carbon dioxide to reinforce antibacterial nanofillers into polymers to achieve products that inhibit the growth of gram-positive and gram-negative bacteria. There nanofillers incorporated into plastics products at the point of manufacture provide ongoing protection for expected lifetime of the product. These nanoparticles can be manufactured through simple protocols using lab grade chemicals like Montmorillonite, Zinc Chloride, Silver Nitrate, Sodium Hydroxide, Methanol etc. The process makes use of clean, cheap and reusable alternative to volatile organic solvents i.e. supercritical fluids like carbon dioxide (CO_2) to facilitate the infusion of antibacterial nanofillers into polymer using temperature and pressure controlled single pot reactor system. Antibacterial nanofillers are incorporated into polymer matrix swollen in supercritical liquid. This comprises the steps of: mixing a monomer and a polymerization initiator to get a mixture; contacting the said mixture with supercritical fluid i.e. liquid CO_2 at a temperature below 100°C and pressure in the range of 1000-1500 psi to induce the *in-situ* polymerization. Alternatively, monomer and initiator may be replaced with matrix polymer. Carbon dioxide may be recycled simply through depressurization of reactor system to make the process energy efficient. CO_2 is an inexpensive, non-toxic, environmentally friendly and non-flammable alternative to organic solvents for preparation of antibacterial polymers especially plastics.





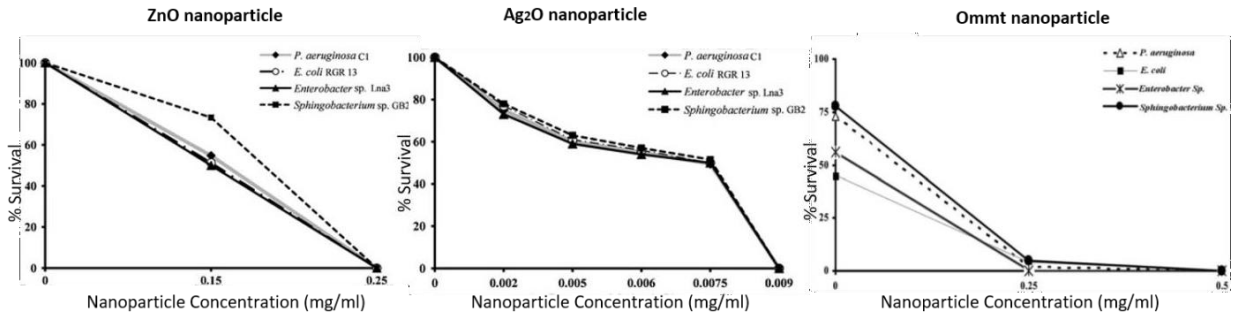
UNIQUE SELLING PROPOSITIONS

- Compared to organic antibacterial agents, these metal oxide nanoparticles display an inherent particle-size dependent antibacterial activity and toxicity, chemical stability, thermal resistance, and long-lasting action.
- The antibacterial nanocomposites offer a wide spectrum of applications as films for packaging, coatings for plastic and food packaging, functional textiles for medical and domestic applications to achieve improved hygiene standards with reduced health risks.
- The supercritical fluid assisted compounding requires less energy input as compared to existing compounding methods.
- The supercritical fluid assisted technology is a substitute for the conventional organic solvents assisted technology that is generally used for preparation of antibacterial polymers.
- The technology provides antibacterial polymers without leaving any solvent residue in the product. The use of present invention is a cost-effective solution to the adverse effects originating from similar products which makes use of organic solvents which emits toxic substances.



Increased Antibacterial property in response to Nanoparticles concentration:

Zone of Inhibition Assay showinginhibitory effect of variable concentrations of ZnO, Ag_2O, and Ommt nanoparticles against test bacterial strain



Bactericidal Assay: Reduction in therate of survival of test bacteria Pseudomonas aeruginosa, E. coli RGR13, Enterobacter sp. Lna3, and Sphingobacterium sp. GB2 in the presence of ZnO, Ag_2O, Ommt nanoparticles in comparison to unexposed cells after 16 h of incubation (in 10 mL nutrient broth with 10^7 CFU/mL).

STAGE OF DEVELOPMENT

- Proof of Concept has been established in the laboratory
- In-house validation conducted

APPLICATIONS

Potential Industry segments:

- **Healthcare:** Medical devices, medical plastics, seating, countertops, storage
- **Fabrications:** PVC blinds, car interiors, packaging, signs, electronics, seating
- **Fitness:** Yoga mats, footwear, duffle bags, sports equipment
- **Housewares:** Cutting boards, wall coverings, appliances, toilet seats, flooring, mattresses
- **Building Products:** Flooring, vinyl siding, windows, insulation, piping, roofing membranes

INTELLECTUAL PROPERTY

Patent granted in India.

LICENSING OPPORTUNITY

BCIL is looking for suitable industrial partner for commercialization of this Antibacterial polymer production technology.

CONTACT:

Dr. Purnima Sharma, Managing Director

BIOTECH CONSORTIUM INDIA LIMITED

V Floor, Anuvrat Bhawan, 210, Deen Dayal Upadhyaya Marg,
New Delhi:110002 Phone: +91-11-23219064-67,
Fax: +91-11-23219063
Email: tto.bcil@biotech.co.in & info.bcil@biotech.co.in
Website: www.biotech.co.in