

INORGANIC ANTIMICROBIAL PRODUCTS

DATA SHEETS

NANOMATERIALS AND NANOTECHNOLOGY RESEARCH CENTER (CINN)

AVENIDA DE LA VEGA 4-6. 33940. EL ENTREGO, SPAIN

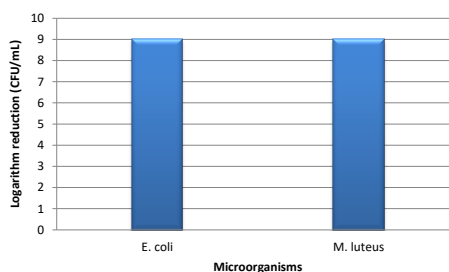
+34 985733644

WWW.CINN.ES

Kaolin/Metakaolin-nAg[®]

PRODUCT SPECIFICATIONS

Composition	Silver nanoparticles attached to an aluminosilicate matrix
Microbiological Efficacy	Bactericidal Has proven to show a consistent microbial reduction rate [3 log (> 99.9%)] against a broad range of bacteria under different antimicrobial test



Logarithm of reduction of Kaolin-nAg[®]

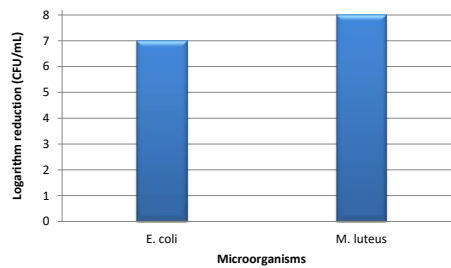
The broad biocidal activity of these glass particles was attributed to the release of Ag or Cu

Types	Powder, granules
Security	Non toxic
Benefits	Delivers intrinsic and long-lasting antimicrobial efficacy Controlled-release kinetic of the nanoparticles
Applications	Wide-ranging applications: <ul style="list-style-type: none"> • Ceramics • In the manufacture of paper (coating, pigment, filler), • Inks and paints (as an extender) • Additive in the production of rubber and polymers, cosmetics... • Concrete
Cost	Production cost is only related to Ag market value. It is a simple production process involving conventional spray dry technology

Kaolin/Metakaolin-nCu[®]

PRODUCT SPECIFICATIONS

Composition	Copper nanoparticles attached to an aluminosilicate matrix
Microbiological Efficacy	Bactericidal Has proven to show a consistent microbial reduction rate [3 log (> 99.9%)] against a broad range of bacteria under different antimicrobial test



Logarithm of reduction of Kaolin-nCu[®]

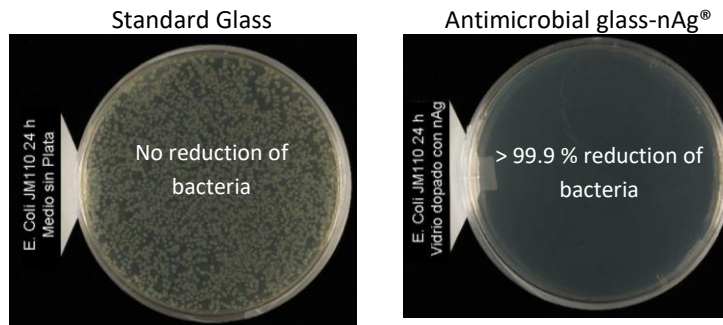
The broad biocidal activity of these glass particles was attributed to the release of Cu

Types	Powder, granules
Security	Non toxic
Benefits	Delivers intrinsic and long-lasting antimicrobial efficacy Controlled-release kinetic of the nanoparticles
Applications	Wide-ranging applications: <ul style="list-style-type: none"> • Ceramics • In the manufacture of paper (coating, pigment, filler), • Inks and paints (as an extender) • Additive in the production of rubber and polymers, cosmetics... • Concrete
Cost	

GLASS-nAg®

PRODUCT SPECIFICATIONS

Composition	A wide range of glass formulations Silver nanoparticles lye embedded on an inert glassy matrix
Microbiological Efficacy	Broad spectrum: Bactericidal and Fungicidal Has proven to show a consistent microbial reduction rate [3 log (> 99.9%)] against a broad range of bacteria under different antimicrobial test



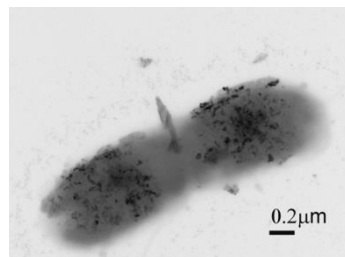
The broad biocidal activity of these glass particles was attributed to the synergistic effect of Ag and Ca²⁺ release

Types	Powder, granules, fibers
Security	Non toxic
Benefits	Delivers intrinsic and long-lasting antimicrobial efficacy Controlled-release kinetic of the nanoparticles
Applications	Wide-ranging applications: <ul style="list-style-type: none"> • Healthcare setting • Furniture surface tops where reduced microbe load is highly desirable • Agriculture • Textile • Printing Ink • Sanitary Material • Cosmetics
Cost	

GLASS-nCu®

PRODUCT SPECIFICATIONS

Composition	A wide range of glass formulations Copper nanoparticles lye embedded on an inert glassy matrix
Microbiological Efficacy	Broad spectrum: Bactericidal and Fungicidal Has proven to show a consistent microbial reduction rate [3 log (> 99.9%)] against a broad range of bacteria under different antimicrobial test



Transmission electronic microscopy micrograph of E.coli after 90 min of the biocidal test. Copper nanoparticles penetrated into the cytoplasm causing the dead of the cell.

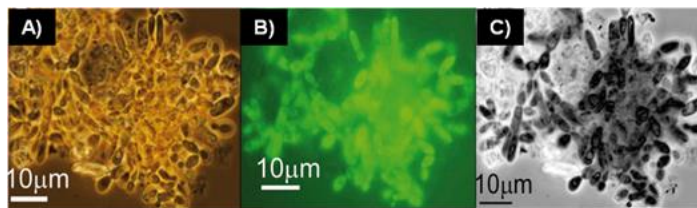
The broad biocidal activity of these glass particles was attributed to the synergistic effect of Cu and Ca²⁺ release

Types	Powder, granules, fibers
Security	Non toxic
Benefits	Delivers intrinsic and long-lasting antimicrobial efficacy Controlled-release kinetic of the nanoparticles
Applications	Wide-ranging applications: <ul style="list-style-type: none"> • Healthcare setting • Furniture surface tops where reduced microbe load is highly desirable • Agriculture • Textile • Printing Ink • Sanitary Material • Cosmetics
Cost	

CaO enriched GLASS®

PRODUCT SPECIFICATIONS

Composition	A wide range of glass formulations Glasses belonging to B ₂ O ₃ -SiO ₂ -Na ₂ O-ZnO system
Microbiological Efficacy	Broad spectrum: Bactericidal and Fungicidal Has proven to show a consistent microbial reduction rate [3 log (> 99.9%)] against a broad range of bacteria under different antimicrobial test



Optical micrographs corresponding to a culture of *C. krusei* after 1 h supplemented with the biocidal glass®: A) under phase contrast light, B) under fluorescence light, C) superimposed micrographs where the black colour cells correspond to dead cells.

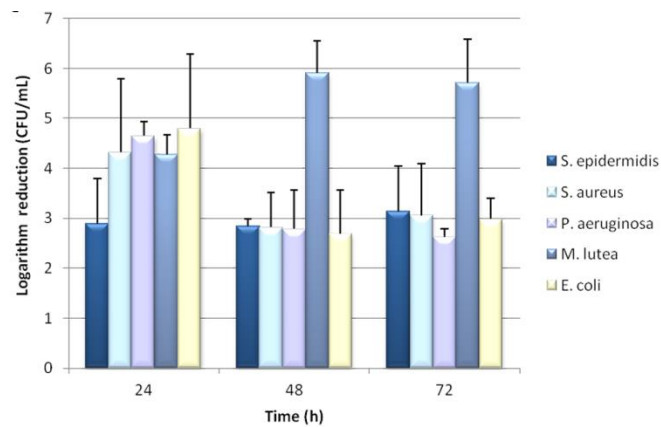
The broad biocide activity of the Ca-rich glass particles was attributed to the depolarization of the cell membrane, as a consequence of the very high punctual concentration of Ca²⁺ at the glass-membrane interface.

Types	Powder, granules, fibers
Security	Non toxic
Benefits	Delivers intrinsic and long-lasting antimicrobial efficacy
Applications	Wide-ranging applications: <ul style="list-style-type: none"> • Healthcare setting • Furniture surface tops where reduced microbe load is highly desirable • Agriculture • Textile • Printing Ink • Sanitary Material • Cosmetics
Cost	

GLASS-CERAMIC®

PRODUCT SPECIFICATIONS

Composition	Glass-ceramic obtained from glasses belonging to SiO ₂ -Na ₂ O-CaO-B ₂ O ₃ system with a high content of calcium oxide (15 to 20 wt.%)
Microbiological Efficacy	Broad spectrum: Bactericidal and Fungicidal Has proven to show a consistent microbial reduction rate [3 log (> 99.9%)] against a broad range of microorganisms under different antimicrobial test Inhibit biofilm formation



Antibiofilm activity of the glass-ceramic® discs respect to standard glass discs

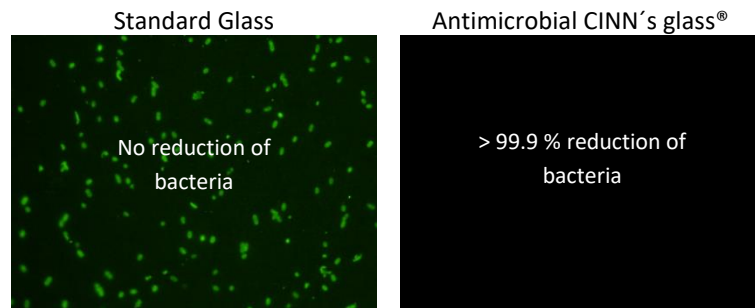
The operating mechanism is similar to that of the parent glass. Cellular calcium ions overload, or perturbation of intracellular Ca²⁺ compartmentalization may cause cytotoxicity and result in either apoptotic, necrotic or autophagic cell death.

Types	Powder, granules, dense piece, scaffolds
Security	Non toxic
Benefits	Delivers intrinsic and long-lasting antimicrobial efficacy
Applications	Wide-ranging applications: <ul style="list-style-type: none"> • Ideal protective cover glass • Healthcare setting • Furniture surface tops where reduced microbe load is highly desirable • Agriculture • Textile • Printing Ink • Sanitary Material • Cosmetics
Cost	

ZnO enriched GLASS®

PRODUCT SPECIFICATIONS

Composition	A wide range of glass formulations. Glasses belonging to B ₂ O ₃ -SiO ₂ -Na ₂ O-ZnO system
Microbiological Efficacy	Broad spectrum: Bactericidal and Fungicidal Has proven to show a consistent [3 log (> 99.9%)] microbial reduction rate against a broad range of microorganisms under different antimicrobial test Inhibit biofilm formation



The broad biocidal activity of these glass particles was attributed to the ZnO. ZnO has been widely used as antibacterial. To date, a number of mechanisms have been proposed to interpret the antibacterial or cytotoxic activity. These include toxicity based on chemical composition (e.g. release of toxic ions); production of reactive oxygen species (ROS); stress of stimuli caused by the surface, size and shape of particles; damage to membrane cell wall through adhesion on the cell membrane; penetration through the membrane cell wall; and cellular internalization of nanoparticles.

Type	Powder, granules, dense piece, fibers
Security	Non toxic
Benefits	Delivers intrinsic and long-lasting antimicrobial efficacy Controlled-release kinetic of Zn ions
Applications	Wide-ranging applications: <ul style="list-style-type: none"> • Ideal protective cover glass • Healthcare setting • Furniture surface tops where reduced microbe load is highly desirable • Agriculture • Textile • Printing Ink • Sanitary Material • Cosmetics • Filler
Cost	