Bactericides and fungicides

Protection against pathogens

Nanosilver: nanoAg

The antibacterial effect of silver is well known since thousands of years. Silver vessels were used by ancient civilizations, because people observed that food lasts longer when contained in this material. In XIX and XX century many advances and breakthroughs in chemistry and biology took place. This allowed to synthetize sulfonamides and to produce antibiotics at mass scale. At the end of XX and in the beginning of XXI century scientists observed that some bacterial pathogens immunized themselves to most known antibiotics, nowadays cases of complete immunity of bacteria are even more frequent. Humanity is losing their main weapon against bacteria. There is a solution – we need to return to the roots and use silver once again.

We combined recent advances in material science, namely nanotechnology, with well-known and confirmed biocidal activity of silver. Our silver-based products are efficient and easy to use. We created technologies that provide very high activity of silver nanoparticles and long lasting protection against bacteria and fungi pathogens.

New standards of protection, comfort and hygiene

SNTnanoCARE technology provides permanent antibacterial protection. Biological activity of our silver-based systems allows to expand the protection period which allows to obtain self-decontaminating products. Products like that can protect the user during entire lifetime. This is a new standard in antibacterial protection.

Nanosilver antibacterial mechanism

Nanosilver particles trapped in a material prevent microorganisms growth in several ways:

- Silver is a catalyst for oxidation of many compounds that are essential for bacteria metabolism – bacteria losses its ability to respire, its DNA is damaged.
- When contacted with cell wall nanosilver blocks the transport of mass through the wall.
- Protein structure is disturbed leading to the death of the bacteria.
- Nanosilver interferes with DNA chemistry and destroys DNA's bonds. The replication process is blocked and bacteria cannot transfer the information about new threat to further generations of pathogens.

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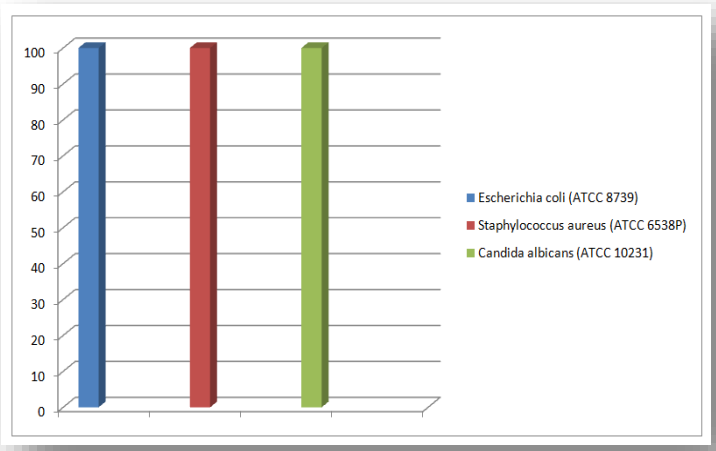

100% reduction level of microbial pathogens on polymer surfaces with Smart Nanotechnologies nanosilver (according to ISO 22196)

Nanosilver efficiency

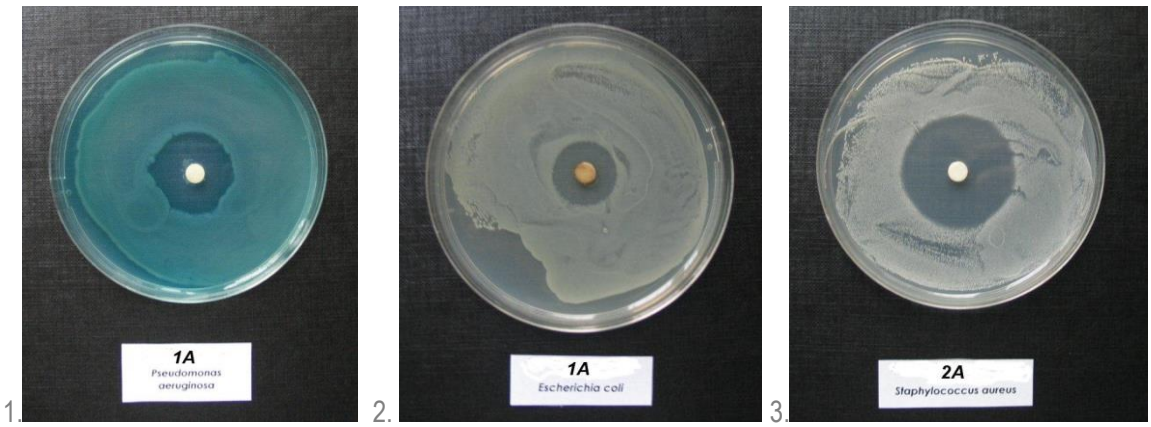

Figure showing the effect of nanosilver saturated roundel (5ppm concentration) on bacteria: (1.) Escherichia Coli, (2.) Staphylococcus Aureus, (3.) Pseudomonas Aeruginosa

These are typical strains, responsible for many infections often with serious complications. Concentration of 5 ppm means that the ratio of silver nanoparticles to the entire solution is equal to 5 to 1 000 000. The effect is very strong not only on the surface of immediate contact buy in a large radius from the roundel due to silver ions migrating from the particles. The spheres of action have few millimeters up centimeter, which is a colossal distance in the microorganism world. Depending on the application conditions, typical concentrations of nanosilver in Smart Nanotechnologies products vary from 5 to 50 ppm.

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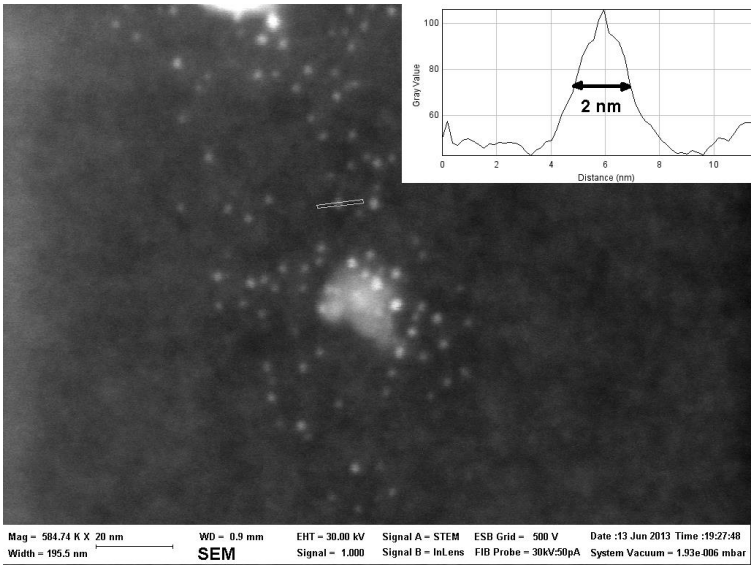

A scanning electron microscope image of nanosilver deposited on nanosilica. This figure shows the structure of a material synthesized at Smart Nanotechnologies. The bar below the picture represents 20 nm.

The size of nanosilica particles is equal to about 10-15 nm, the diameter of single silver particles ranges from 1-3 nm.

Nanocopper: nanoCu

The antimicrobial effect of copper is also known for ages. Medieval sailors used copper element to build ships, which reduced the growth of alga and seaweeds. Based on that observation people tried to use copper for food storage, but copper as a semi-noble metal is readily oxidized. The oxidation is even faster in acidic conditions, and the reaction products contaminate the food.

Metallic silver has very good antifungal activity. But the challenge is to obtain copper based systems that are able to penetrate fungi cell walls. These walls build mostly out of chitosan are protecting the cell against external conditions to high extent. Still, metallic and copper (I) nanoparticles of small enough dimension can transverse this barrier. When copper gets into the cell, a series of redox reactions starts, interfering with protein formation, growth of the cell and chitosan synthesis. At the end of this process the fungi organism is not able to synthetize any enzymes required for its life processes.

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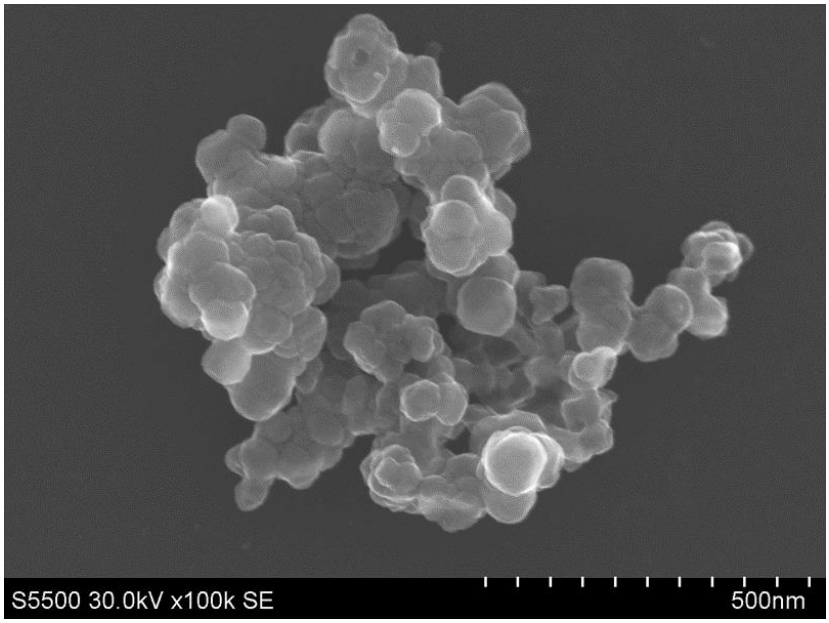
nano Copper (I) oxide
nanoCu_2O

nanosilica nSiO_2 + 10% nano Cu_2O

nano copper (I) oxide + nano Ag

Our company developed technologies of obtaining copper-copper (I) complexes. This systems are used to produce antifungal products, for protections of surfaces made of wood, polymers, or textiles. One example of application is the protection of boats against algae and lichens. Moreover nanocopper is effective against gram-positive bacteria and against some types of protozoa and nematodes.



Copper (I) oxide nanoparticles on a polymer carrier.

The size of single Cu2O particles ranges from 20 to 50 nm.

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Applications

SNTnanoCARE technology is applicable everywhere where there is a risk of bacteria or fungi growth. Expansion of pathogens leads to diseases and infections and generates high costs of treatment.

SNTnanoCARE „better to prevent then deal with consequences”

- Long lasting protection (infinite compared to other products),
- High safety and hygiene,
- Reduction of exploitation costs,
- Enhanced functionality without disturbing other properties,
- Discriminant of a brand.

Let’s change the future together

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