

# NanoAg

PLASTIC PRODUCTS  
FUNCTIONALISED WITH  
SILVER NANOPARTICLES

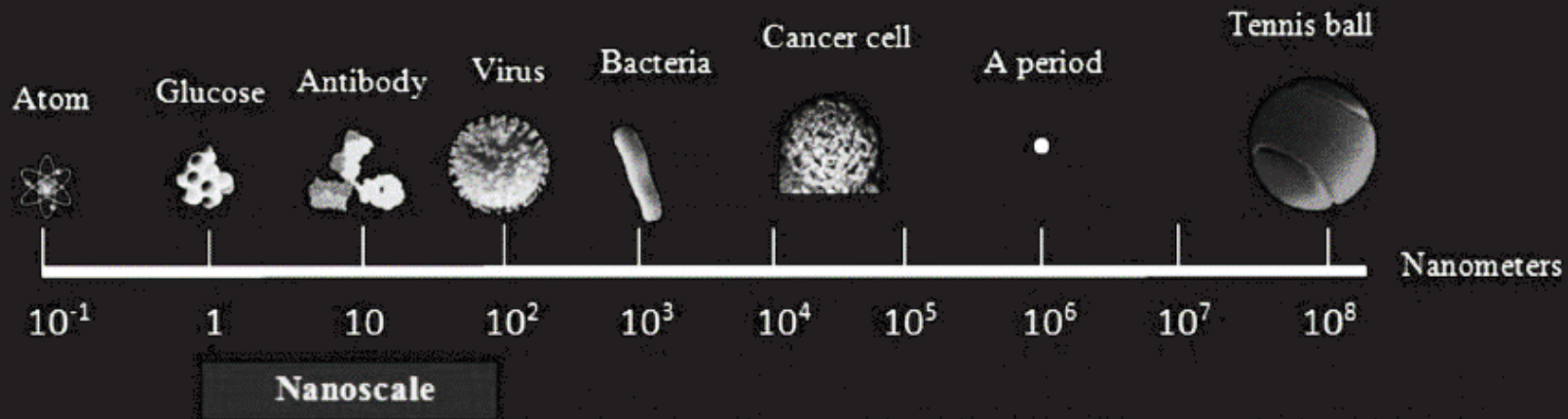


ITP-SYSTEM 2019

## WHAT IS NANOSILVER?

Nanosilver is a product with unique properties. Silver as a noble metal is characterized by low reactivity and high stability, as well as strong biocidal properties against a broad spectrum of microorganisms. Reducing the size of silver to the nanoscale (nanometer is a billionth of a meter) causes a strong increase in silver activity, which depends on the contact surface of molecules with microorganisms.

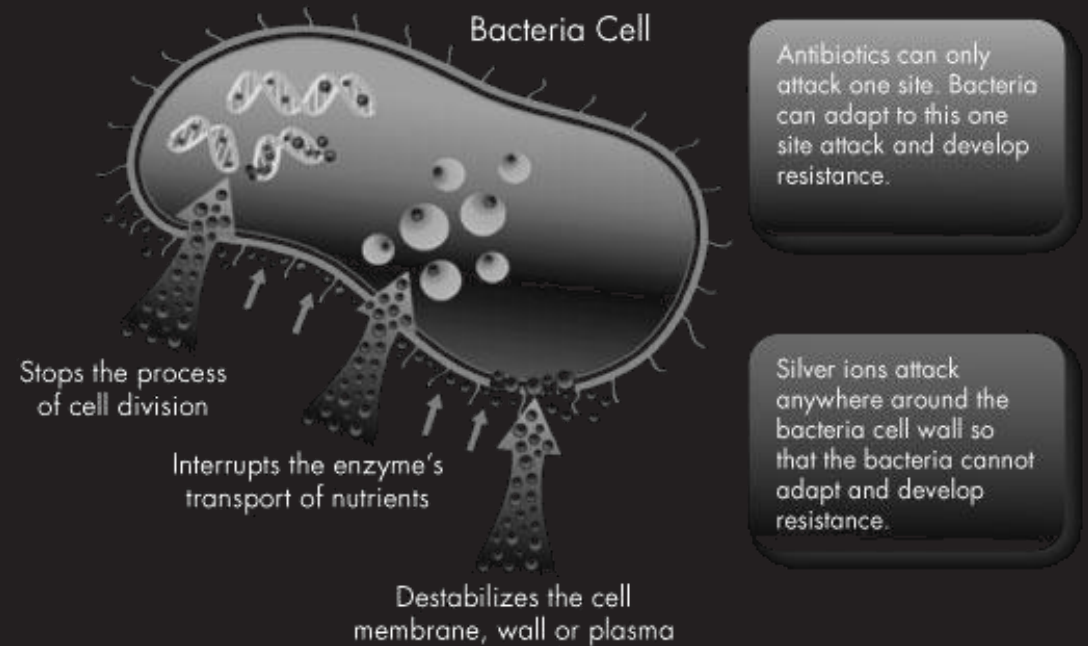
Each gram of nanosilver has a gigantic surface similar to a football pitch!



## ACTIVITY AGAINST MICROBES

Depending on the content of nanosilver in the finished product, different levels of microbial protection (from bacteriostatic to bactericidal) are obtained. In most cases good effect is achieved in concentration 1-25 ppm. For many substances these are trace concentrations, but for nanosilver sufficient to protect against 650 species of bacteria, molds, viruses and fungi. The effectiveness of the nanosilver addition has been repeatedly confirmed by numerous microbiological tests that we always perform on ready-to-use products.

The advantage of active silver particles against conventional chemicals is their permanent effect on microbial cells. The saturation of the surface with nanosilver prevents the growth of microorganisms and reduces the risk of infection. Microorganisms penetrating into tissues can cause numerous diseases often with serious complications.



## ADVANTAGES OF USING NANOSILVER

- Nanosilver works nonspecifically on a very wide range of microorganisms (bacteria, fungi, molds, algae, viruses, primitive Eucaryota) including common pathogenic species;
- It is a product resistant to chemical, physical and biological factors. Microorganisms can not defend against it as opposed to commonly used synthetic biocides;
- Nanosilver is a safe product for humans, animals and the natural environment;
- Silver on the nano scale works with trace amounts. It eliminates biofilms on saturated surfaces;
- Nanosilver does not undergo self-degradation and is practically indefinitely long-lasting in plastics.



## NANOSILVER IN PLASTICS

The small size of silver nanoparticles, their enormous activity and durability are the features that allow their use in plastics processing. The saturation of materials with nanosilver guarantees microbiological protection unlimited in time.

This is of cardinal importance for the high sanitary standards of plastic products!

### METHOD OF PLASTICS PRODUCTION FROM POLYMER GRANULES FUNCTIONALIZED WITH NANOSILVER

1. Saturation with nanosilver of polymer granules in the ITP-System laboratory (we obtain a silver concentrate in granules);
2. Dosing of the functionalized granules to the molten material and their **thorough mixing**;
3. The extrusion of the finished product.



## ADVANTAGES OF ITP-SYSTEM TECHNOLOGY

- The technology developed in the ITP-System laboratory allows to obtain high concentrations of silver in functionalized granules. Thanks to this, concentration of additive is relatively small;
- ITP-System functionalizes the granules supplied and used by the manufacturer, thanks to which it is not necessary to modify the production process in any stage;
- The applied nanosilver has a small particle diameter (5-15 nm) which guarantees excellent activity at low concentrations and easy to obtain uniform dispersions;
- Silver used in plastics functionalization is produced in Poland using the highest quality raw materials. The production process does not pollute the natural environment;
- Nanosilver shows a trace migration to the environment, which guarantees product durability and safety of use in the case of products in contact with air or water.

Simulant	Global migration [mg/dm <sup>2</sup> ]
Distilled water	0.57
3% solution of acetic acid	0.23
10% solution of ethyl alcohol	0.13
isooctane	1.33



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