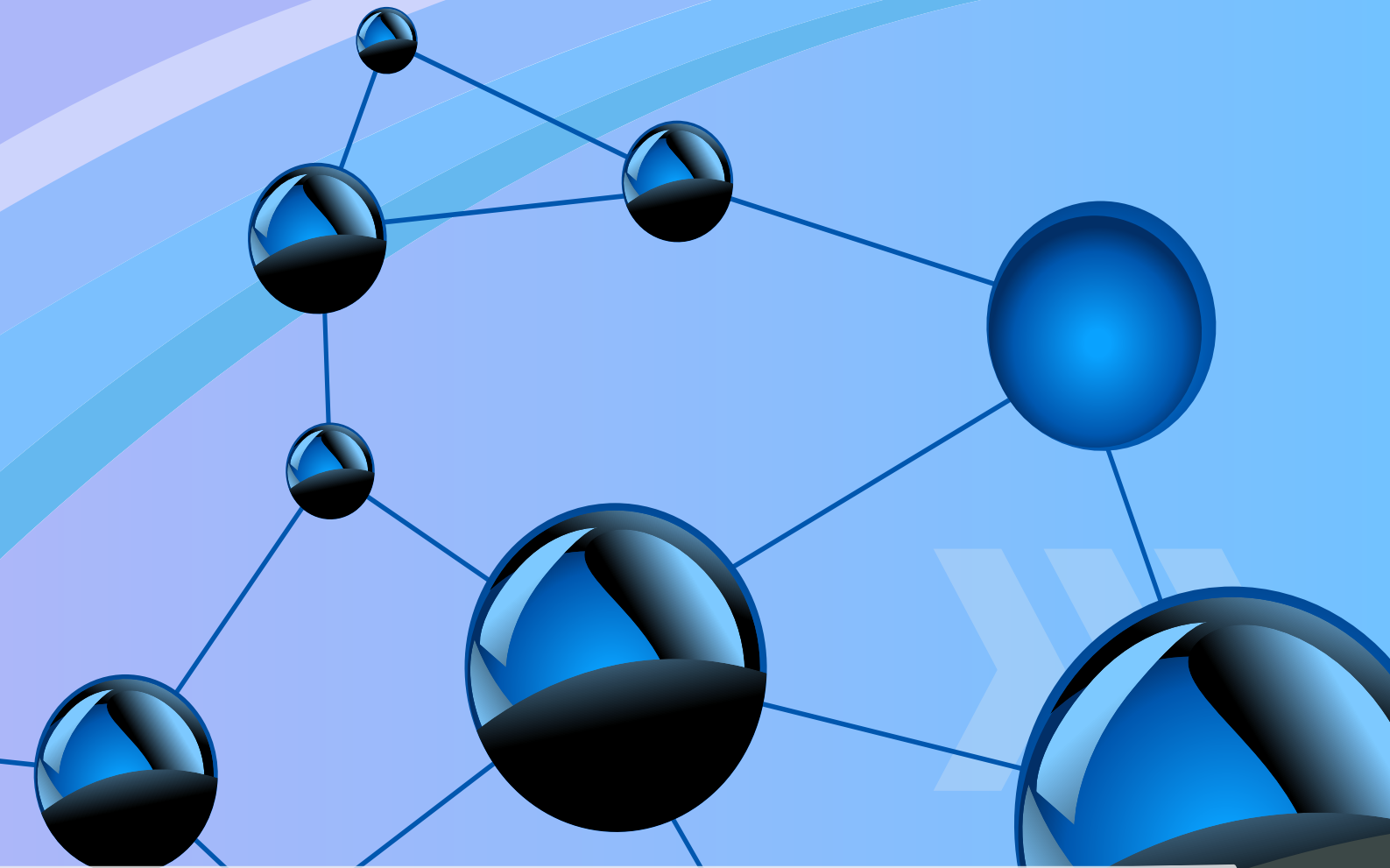
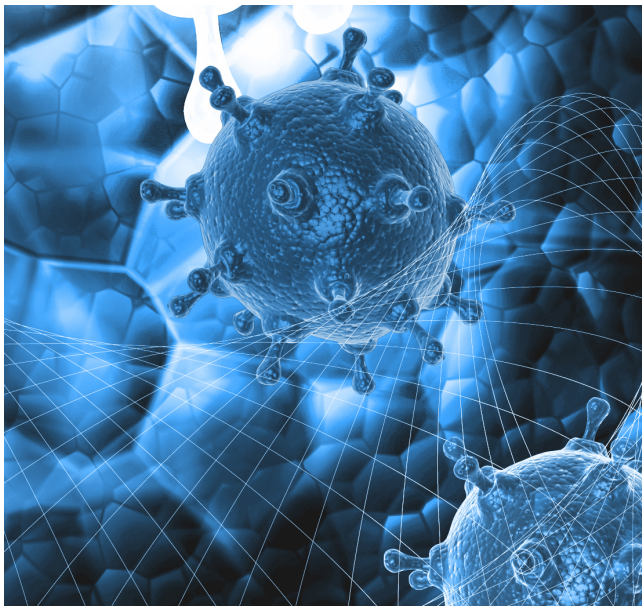


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NANOSILVER FOR PLASTICS

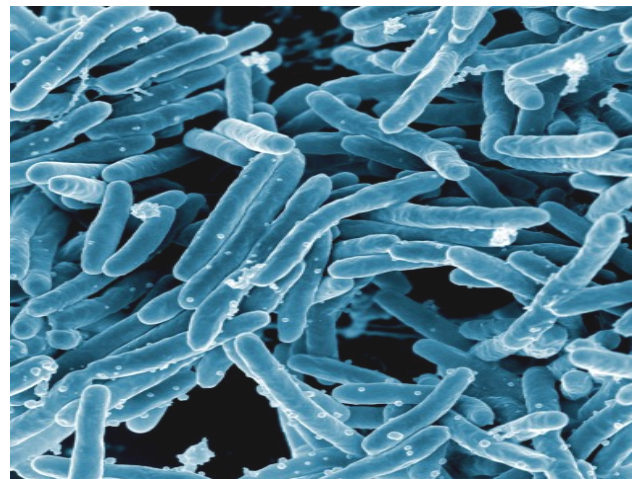
Polymer granules with active silver particles



NANOSILVER AS EFFICIENT BIOCIDES

The latest achievements of material engineering are products with proven, biocidal effect of silver on bacterial and fungal cells. Silver and its components is characterized by very effective and sustainable action. It protects surfaces of products made of plastics against the development of bacteria and fungi and the formation of biofilms.

This innovative technology has allowed us to create a new standard for safety, comfort and hygiene of life with the use of self-decontaminating surfaces of products made of plastic.



OFFER

We offer surface application of the nano-sized granules of polymer silver particles at concentrations of 500 to 10,000 ppm in 1 kg of the granules. Our original method allows for non-invasive application of silver in the granules by admixing to the primary raw material. This innovative process does not affect the physical or chemical properties of the granules.



Way of obtaining products enriched with nanosilver

**Introducing to the market
and marketing activities**



**Testing of final
product properties**



**Analysis of production
process and R&D works for
achieving best effect**

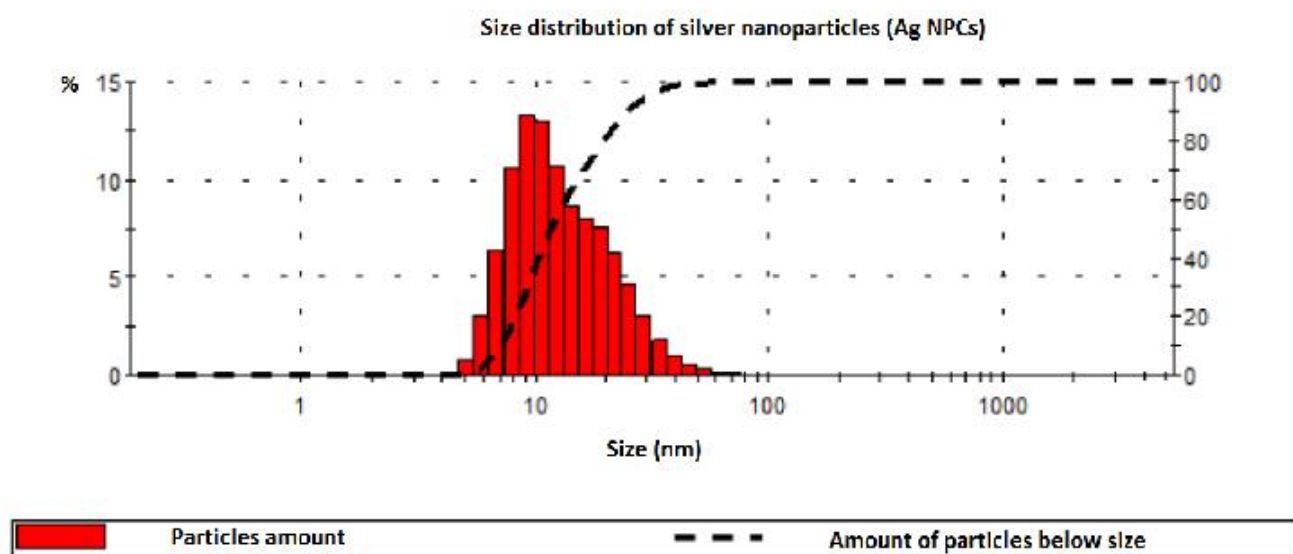


**Meeting and presentation
of product expectations**



NANOSILVER IN PLASTICS

The sizes of silver nanoparticles were examined with Zetasizer Nano ZS. The dashed line in the diagrams shows the average particle size distribution: X nm/100%. The results are presented in the diagram below:





EFFECTIVENESS

Depending on the content of silver in the finished product, we get different levels of microbiological protection (example applications in the finished product):

1-5 ppm – material structure protection against negative effects of bacteria.

80-120 ppm – biostatics / inhibition of bacterial growth on the material surface.

150-400 ppm – biocidality / elimination of bacterial colonies on the material surface.

The effectiveness of antibacterial features of polymer product surfaces enriched with nanosilver has been confirmed in the stringent tests carried out in accordance with the requirements of international standard ISO 22.196: "Plastics. – Measurement of antibacterial activity on plastics surface".

The advantage of active silver over chemicals is its permanent effects on the cells of microorganisms. Covering surfaces with active silver prevents from the growth of microorganisms and reduces the infection risk. Penetrating into body, they can cause many diseases, often with dangerous complications.



MIGRATION

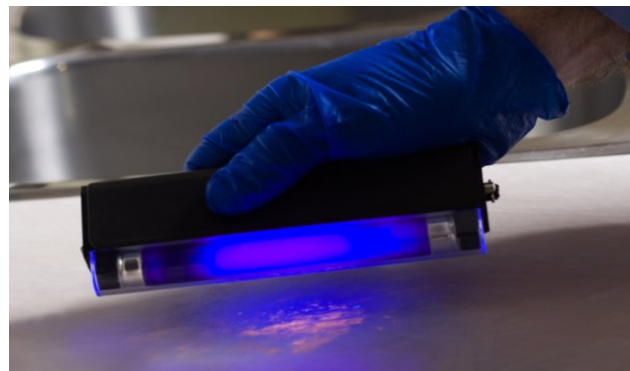
Global migration tests were carried out on PE film, with application of 250 ppm silver particles, in accordance with standards PN-EN 1186-1:2005, PN-EN 1186-3:2005 and PN-EN 1186-14:2005. According to the requirements migration should not exceed 10 mg/dm² (table below):

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

MARKETING ADVANTAGES FOR PRODUCERS

New quality while maintaining the existing values

This new solution does not affect the aesthetics of the products and their conditions of use. There are no visible (or hidden) changes in the quality or structure of the surface.



Collections and designs used in production do not require any additional modifications resulting from adding the new feature.

Effectiveness

Long term use of the products does not cause the deterioration of their properties. The natural process of abrasion of the subsequent layers of the product does not affect its effectiveness, as each next layer is saturated with particles of active silver distributed throughout the product structure.

Safety and health enhancement

It is an innovative and distinctive product with new properties, dedicated for customers who are sensitive in regards to safety and hygiene. The amount of conscious customers has been growing steadily, together with the growing level of public awareness of the microbiological protection.

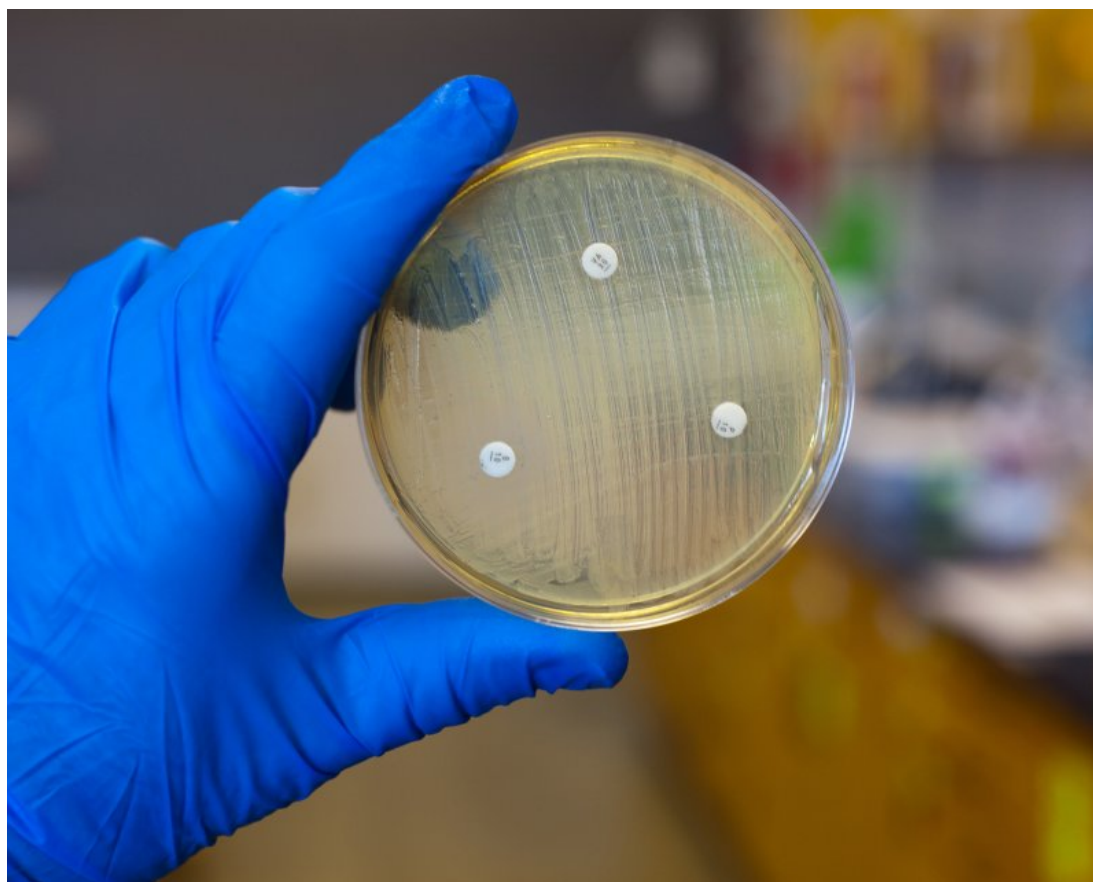


Saving money and protecting the environment

Use and care of self-decontaminating surfaces allows to significantly reduce the amount of applied disinfectants, which brings savings to every user's budget. Another advantage is also a measurable effect on the environment by reducing emissions of these disinfectants to the system of water management.

Attribute for the brand and its customers

Modern products that can ensure the user's comfort and safety are already a standard, expected by the new consumer environments. These days most customers make their purchases consciously, compare their options and expect the possibility of distinguishing their lifestyle.





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