



Biocidal additives containing
silver particles for polymers



POLYDEF Ag+ PVC-U

PRODUCT DATA SHEET

POLYDEF Ag+ PVC-U is a concentrated masterbatch formulated from silver particles (Ag) designed for thermoplastic polymers that adds bactericidal properties to the finished polymer elements.

The presence of silver in the protected polymer ensures a biocidal effect by inhibiting the metabolic pathways of microorganisms, contributing to the elimination of sources of unpleasant smells and the extension of the lifetime of the material. The additive is environmentally friendly, does not affect the physical properties of the polymers and does not cause degradation of the protected material. The component provides long-lasting microbiological protection (microbiological efficacy of $\geq 99.98\%$), as well as enhances the safety and attractiveness of the product. The additive is also very stable at high temperatures and in high humidity compared to traditionally used biocides.

General information

POLYDEF Ag+ PVC-U is added to the finished product during manufacture. The granules provide antimicrobial properties and should not affect the basic colour or surface finish of the product. The active substances do not degrade or leach. The additive is designed to exhibit constant activity throughout the product life cycle.

Recommended dosage

To obtain a bactericidal effect, a dosage of 4-6% by mass relative to the mass of the finished polymer composite is recommended, while to obtain a fungicidal effect, a dosage of 6% by mass is recommended. Validation of the antibacterial additive is recommended before introducing the product to the market.

Test procedure

The analysis is a quantitative test designed to assess the performance of antimicrobial properties. Test samples are incubated with a bacterial suspension for 24 hours at 37°C. The average number of viable bacterial cells and the percentage reduction of the selected microorganism are then calculated.

Microbiological efficacy

Microbiological efficacy Microbiological properties were subjected to testing in accordance with ISO 22196 *Measurement of antibacterial activity on plastics and other non-porous surfaces*, against the following microorganisms:

- *Escherichia coli* ATCC 8739
- *Staphylococcus aureus* ATCC 6538

The reduction efficacy of more than 90% has been confirmed.

Storage

The granules have been developed in a manner that ensures the highest stability during storage and use.

Be aware that silver-containing materials may be sensitive to light and electromagnetic fields. Insufficiently mixed product may cause discolouration in the finished goods, which is why it is the responsibility of the manufacturer of the final component to fully assess it under normal conditions of use.

Before use

It is important, as with all chemicals, to read the product data sheet before use.

Before applying the product, always ensure that you have the latest information. For more information, contact us at kontakt@smartnanotech.com.pl.

The information presented in this document is provided to the best of our knowledge and with due diligence to ensure that it is accurate and up-to-date. Smart Nanotechnologies S.A. shall not be liable for any damages arising directly or indirectly from the use of the information contained herein. The document is issued subject to the user determining the safety and suitability of the product before use. Since regulations are country-specific, local information should be consulted before marketing the product.



MODERN
TECHNOLOGY



SAFE
FOR HEALTH



DURABILITY
OF USE



MANY POSSIBLE
APPLICATIONS



PRODUCER:

Smart Nanotechnologies S.A.
Karola Olszowskiego 25,
32-566 Alwernia, Polska

smartnanotech.com.pl
phone: +48 12 25 89 395



Biocidal additives containing
silver particles for polymers



POLYDEF Ag+ PVC-U

POLYMER MATRIX DATA SHEET



POLYDEF Ag+ PVC-U is a concentrated masterbatch formulated from silver particles (Ag) designed for termoplastic polymers that adds bactericidal properties to the finished polymer elements.

The presence of silver in the protected polymer ensures a biocidal effect by inhibiting the metabolic pathways of microorganisms, contributing to the elimination of sources of unpleasant smells and the extension of the lifetime of the material. The additive is environmentally friendly, does not affect the physical properties of the polymers and does not cause degradation of the protected material. The component provides long-lasting microbiological protection (microbiological efficacy of $\geq 99.98\%$), as well as enhances the safety and attractiveness of the product. The additive is also very stable at high temperatures and in high humidity compared to traditionally used biocides.

Parameter	Standard	Value	Unit
Density	PN EN ISO 1183	1,16	g/cm ³
Tensile strength	ISO 527-1	35,0	MPa
Relative elongation at break	ISO 527-1	40	%
Thermal stability at 200°C	DIN 57472, 614	15	min
Vicat softening point	ISO 306	82	°C
Flammability, class	UL-94	V-0	-



MODERN
TECHNOLOGY



SAFE
FOR HEALTH



DURABILITY
OF USE



MANY POSSIBLE
APPLICATIONS



PRODUCER:

Smart Nanotechnologies S.A.
Karola Olszowskiego 25,
32-566 Alwernia, Polska

smartnanotech.com.pl
phone: +48 12 25 89 395



REPORT

Evaluation of the biocidal properties of PVC-U-based composites

Materials and methods:

The experiment was performed according to ISO 22196: Plastic - Measurement of antibacterial activity on plastics and other non-porous surfaces.

Test microorganisms:

- *Escherichia coli* (ATCC 8739)
- *Staphylococcus aureus* (ATCC 6538)

Contact time:

- 24 hours

Number of viable bacteria in the inoculum:

- *Escherichia coli* – $7.5 \times 10^5 \text{ cfu} \cdot \text{cm}^{-2}$
- *Staphylococcus aureus* – $7.5 \times 10^5 \text{ cfu} \cdot \text{cm}^{-2}$

Table 1 Number of viable bacteria on control and test samples.

Escherichia coli						
Assessed parameter	Control sample immediately after inoculation	Control sample after 24 h	Sample with 2 wt.% after 24 h	Sample with 4 wt.% after 24 h	Sample with 6 wt.% after 24 h	
Average number of viable bacteria cells [cfu·cm ⁻²]	1.1×10^5	3.2×10^4	0	0	0	
Average of the common logarithm of the number of viable bacterial cells	5.0	4.5	0	0	0	
Staphylococcus aureus						
Assessed parameter	Control sample immediately after inoculation	Control sample after 24 h	Sample with 2 wt.% after 24 h	Sample with 4 wt.% after 24 h	Sample with 6 wt.% after 24 h	
Average number of viable bacteria cells [cfu·cm ⁻²]	1.2×10^5	5.5×10^2	0	0	0	
Average of the common logarithm of the number of viable bacterial cells	5.1	2.7	0	0	0	



MODERN
TECHNOLOGY



SAFE
FOR HEALTH



DURABILITY
OF USE



MANY POSSIBLE
APPLICATIONS



PRODUCER:
Smart Nanotechnologies S.A.
Karola Olszewskiego 25,
32-566 Alwernia, Polska
smartnanotech.com.pl
phone: +48 12 25 89 395



Table 2 Antimicrobial activity and reduction of bacteria on tested surfaces.

Dosage	<i>E. coli</i>		<i>S. aureus</i>	
	Antimicrobial activity [log]	Reduction in number of bacteria [%]	Antimicrobial activity [log]	Reduction in number of bacteria [%]
2 wt.%	4,5	100,0	2,7	100,0
4 wt.%	4,5	100,0	2,7	100,0
6 wt.%	4,5	100,0	2,7	100,0

Graph 1. Antimicrobial activity and reduction of bacteria on tested surfaces.

