

Technical Information

TI/L 1011c

february 2010

AgPURE™ W

™= trademark of ras materials GmbH

Aqueous nanosilver dispersion used as an antimicrobial agent.



AgPURE™ W

Chemical nature	Aqueous dispersion of colloidal silver.
Delivery form	Orange-brown colloidal dispersion.
Storage	AgPURE™ W can be stored in original containers for 12 months at a temperature range of 10-30 °C. Contents of unsealed containers should be used as soon as practicable. Subsequent to any removal of material, the containers should be closed tightly. Keep product protected against frost.

Properties

	unit	value	dev.
Specification			
solids	weight %	1,0-25,0	0,5
density	kg/dm ³	1,1-1,5	0,03
pH		7,2	0,3

	unit	value	dev.
Additional data			
Ag content, total	Gew.-%	5,0-25,0	0,5
Ag content, ionic	Gew.-%	<0,2	0,05
boiling point	°C	102	2
color		orange	
solvent		water	
particle size	nm	15	-

Miscibility

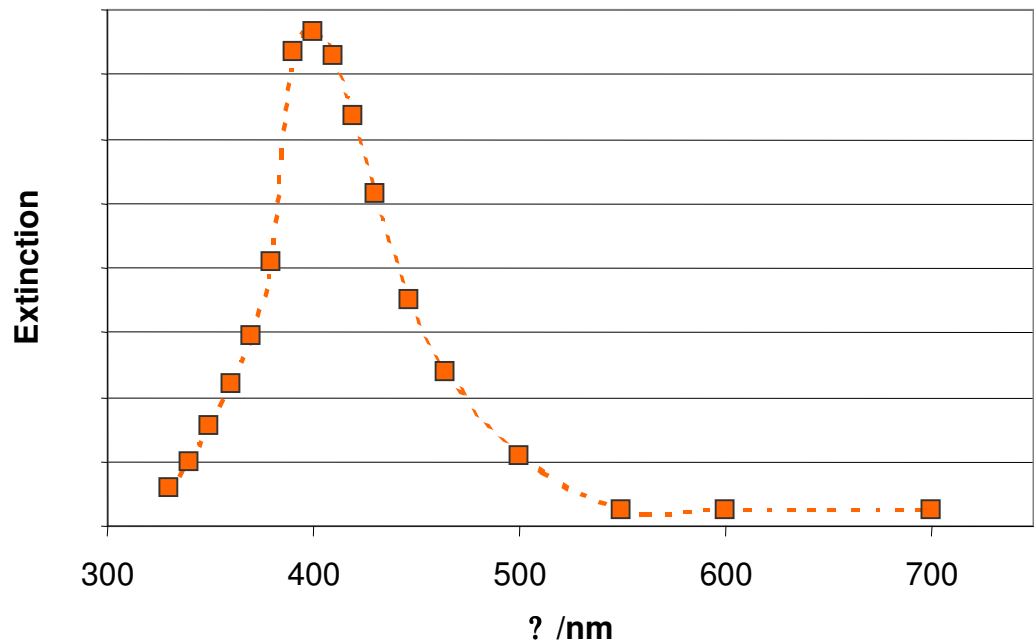
AgPURE™ W dispersions are miscible with water at any ratio. Precipitation or agglomeration will not occur with pure water. Such dispersions show excellent stability.

In case of addition of other solvents, salts or solids, agglomeration might occur. Preliminary tests are recommended to assess compatibilities with other components.

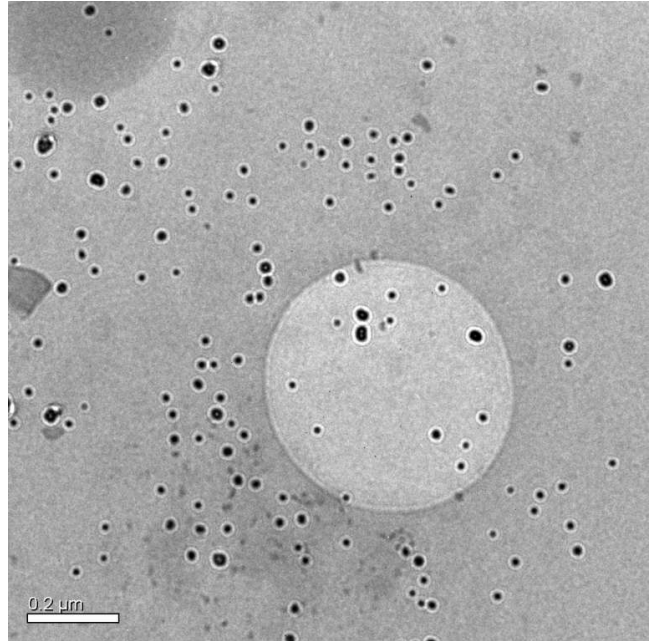
Particle size

The particle size of AgPURE™ W dispersions can be analysed easily with the use of UV absorption spectroscopy. The width of the resulting peak correlates with particle size distribution, the peak height with particle size.

The peak maximum of AgPURE™ W is at 410 nm, which corresponds to a mean particle size of 15 nm.



UV/VIS spectra of AgPURE™ W in aqueous solution.



TEM picture: AgPURE™ silver nanoparticles

Application

AgPURE™ W is designed for the antimicrobial functionalisation of surfaces and bulk materials. Due to the high activity of nanoparticles only low levels of silver are necessary for the best antimicrobial performance. Consequently, the release of silver ions can be fixed at an accurate level ensuring the best antimicrobial efficacy and thus also avoiding cytotoxicity.

Potential applications of AgPURE™ products range from varnishes and coatings over thermoplastic, duroplastic and elastomeric polymers to textile fibers. AgPURE™ W is also utilised as an antimicrobial additive for many chemical formulations like detergents, cleaners and cosmetics.

Additional information for use and application of AgPURE™ W can be requested at our laboratory.

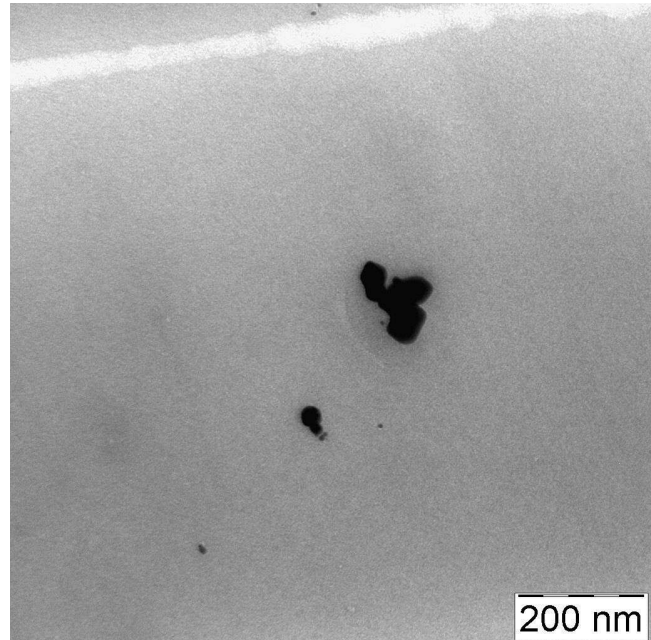
Varnishes

For the manufacture of antimicrobial varnishes, two possibilities can be chosen. AgPURE™ W can be mixed with the pigment paste and subsequently incorporated into the varnish, or simply combined with the varnish dispersion without further preparation. The stability of the obtained nanosilver dispersion should be controlled for afterwards. Coagulation or precipitations of solids should not occur within days subsequent to the mixing process.

It is strongly recommended that the dosage of AgPURE™ W be adapted to the required antimicrobial efficacy of the specific varnish formulation. Standard dosages may be obtained through our laboratory.

Slight discoloration may be occur, whereas the transparency of the resulting varnish should not be affected.

We recommend controlling of the curing process and storage conditions.



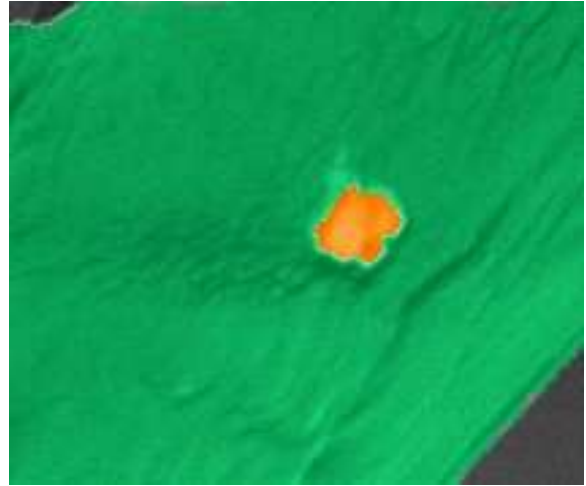
TEM-picture: Particles of AgPURE™ nanosilver in PET fiber.

Textiles & Fibers

AgPURE™ products are widely used for textiles and fibers. It can be applied in various ways ranging from coating, finishing and fiber compounds. AgPURE™ products can be distinguished by their excellent stability at high temperatures (<300 °C). Consequently there are no restrictions in the choice of polymer material.

For fiber spinning processes, AgPURE™ W should be prepared as a masterbatch with the particular thermoplast. Polymers that lend themselves for processing are: Polyester (PET, PBT), Polyamide (PA) among others. The particle size distribution of Nanosilver persists in the fibers resulting in the best efficiency and highest washability without loss of the antimicrobial effect.

AgPURE™ W



SEM-micrograph: AgPURE™ nanosilver on cotton

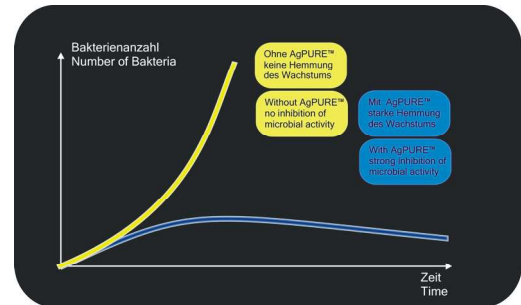
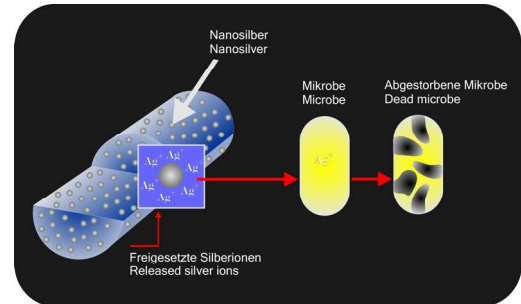
AgPURE™ W is designed for use in dyes and as a component for finishings. Possible textile substrates include natural as well as synthetic fibers. AgPURE W can be formulated both with aqueous or solvent based dispersions. Microbiological evaluations to determine ideal Nanosilver levels are recommended. In some cases colour shifts are possible. Preliminary tests concerning UV stability and washability should be performed.

Standard dosages may be requested at our laboratory.

triple action of SILVER

- » Reduced germ adherence
less colonies, bad growth conditions
- » Disturbance of the germs' metabolism by
exchange of potassium ions
affecting the germs' viability
- » Irreversible reaction with S-containing
amino acids
protein and DNA/RNA damage

AgPURE™ stops explosive germ and mildew
reproduction effectively within a few hours.



Antimicrobial efficacy

AgPURE provides antimicrobial activity to all properly equipped products. AgPURE exhibits strong activity against bacteria and mildew.

Due to the different modes of action (reduction of germ adherence, disturbance of the germs' K⁺-metabolism and irreversible reaction with S-containing amino acids) and due to the marginal Ag⁺-release AgPURE does not induce or propagate bacterial resistance.

Products properly equipped with antimicrobial AgPURE are non-toxic to humans and animals.

Due to the slow release of silver-ions (oxidation of metallic silver followed by elution of Ag⁺-ions) the antimicrobial effect of products supplemented with AgPURE is very persistent.

AgPURE is a long-term shield against antimicrobial growth. It is not a sterilising agent and does not have long range effects.

Test procedures for the verification of the antimicrobial effect based on strong release / long range action of a biocide (e.g. zone of inhibition test) will not respond to AgPURE products.

The detection and certification of the antimicrobial activity of products designed with AgPURE, must be completed with approved microbiological test routines.

In order to support our clients in the design of antimicrobial products, we provide our chemical and biological know-how. We recommend to carefully test all factors that may influence the release of bioactive silver.

Approved test routines to the optimisation of AgPURE addition are:

Proliferation-test -- AgPURE test samples are contaminated with standard germs, washed and finally examined for secondary proliferation of bacteria.

Modified JIS Z 2801:2000 – Inhibition of bacterial growth in a drop of nutrient solution that has been in contact with the products surface.

Modified JIS L 1902:2002 (E) -- Determination of bacterial growth on textile surfaces and woven fabrics containing types of silver.

Further information concerning the microbiological activity and the appropriate test routines can be obtained from our laboratory. We provide the necessary support to develop antimicrobial products and formulations as well as to interpret test results.

sample	number of bacteria (after 24 h)	killing rate	antimicrobial activity (R-value)
antimicrobial PET-microfiber containing AgPURE	$1,5 \times 10^{-5}$	99,1%	2,0
standard microfiber (untreated)	$1,7 \times 10^{-7}$	0,0%	-
inoculum (number of added bacteria)	$1,5 \times 10^{-4}$		

Test results according to JIS L 1902:2002: AgPURE in PET-microfiber. (significant extinction rate: R-value = 2,0)

Safety

When handling this product, due attention should be paid to the information and details in the material safety data sheet. Furthermore, all precautions necessary for handling chemicals must receive careful attention.

Note

The information submitted in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application, these data do not relieve manufactures from the responsibility of carrying out their own tests and experiments; neither do they imply any legally binding assurance of certain properties or of suitability for a specific purpose. It is the responsibility of those, to whom we supply our products, to ensure that any proprietary rights and existing laws and legislation are observed.

ras materials GmbH
nanomaterials
D-93059 Regensburg, Germany
www.nanosilber.de

