

SILVERPLUS®

Earth's antimicrobial - the leading silver ion technology

For obtaining hygiene, protection and freshness – in everyday life and under extreme conditions

EPA-registration, OEKO-TEX®-Standard 100 and bluesign® approval depending on the SILVERPLUS® product used

Textile Auxiliaries - Finishing

www.rudolf-group.com

SILVER+
BY RUDOLF GROUP

bluesign®
APPROVED



SILVERPLUS® - Earth's antimicrobial

From the natural element silver to the leading hygiene, protection and freshness technology

Man has counted on silver for centuries - not only as a material for jewellery or articles of daily use, but, above all, because of the bacteriostatic effect of the element silver. In the early modern age for example milk was preserved by using silver coins.

Today, silver is used as an effective bacteriostatic agent in the most diverse fields, such as cosmetics or medicine.

Ranging from silver-containing gauze to overalls metallised with silver, which are used in neurodermatitis treatments - today, modern medical technologies are unthinkable without silver. For many years the **RUDOLF GROUP** too has intensively engaged in the modern fields of application of silver and has found innovative solutions.

SILVERPLUS® unique technology provides hygienic and fresh effects of the element silver to water-repellent finishes, coatings or as an aftertreating agent to many substrates or application processes.

SILVERPLUS® applications

- Initial textile finish of hotel linen, hospital linen, sports articles, shoes, workwear, tropical clothing bed linen, rental linen
- Hygienic and fresh functions in membranes
- Care products for shoes
- Post-impregnations (wash-in)



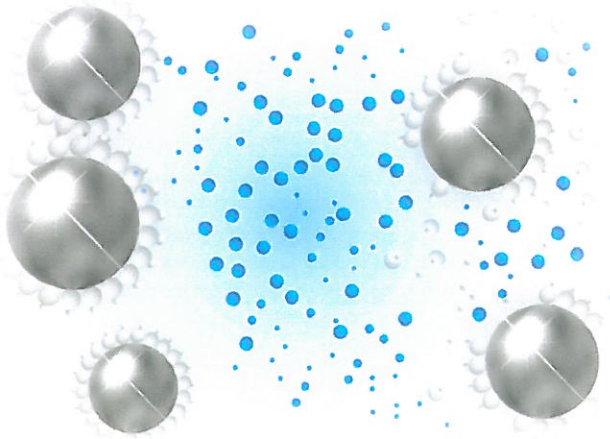


SILVERPLUS®

Maximum effects with minimum consumption of resources

SILVERPLUS® transfers the element silver into a silver compound which has been applied to microstructured substrates by means of highly innovative coating procedures. One gram of microstructured **SILVERPLUS®** active ingredient has a superficial area of ca. 600,000 cm². The advantage of the enlargement of the superficial area is that the consumption of resources can be minimised by the factor 100 compared with metallic silver. At the same time, the effects are maximised, similar to the mode of action of platinum in automotive exhaust catalysts.

Due to this highly innovative procedure a virtually infinite deposit is created from which highly effective positive silver ions are set free in small (some ppm) exactly dosed quantities whenever needed, i.e. in the presence of moisture.



-  ... Titanium dioxide
-  ... Silver chloride
-  ... Silver ion
-  ... Moisture

Setting free silver ions in the presence of moisture





SILVERPLUS®

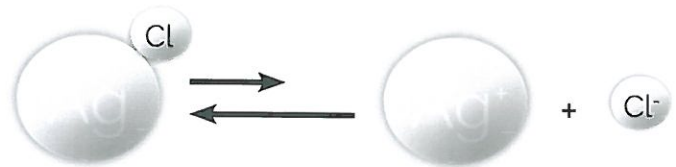
The highly effective silver ion technology with triple effect

Due to the triple effect mechanism of **SILVERPLUS®** many odour-causing bacteria cannot adapt to the effect of silver ions. The antimicrobial effect of the natural element silver is exclusively based on free silver ions. Due to a triple effect mechanism, silver ions with a positive charge have bacteriostatic effects.

SILVERPLUS® is, therefore, capable of contributing to stopping odour-causing bacteria to thus prevent infections in clinics and hospitals, which are e. g. caused by the Methicillin-resistant Staphylococcus Aureus strain (MRSA), from being transmitted*.

SILVERPLUS® may contribute to preventing further infections in hospitals*.

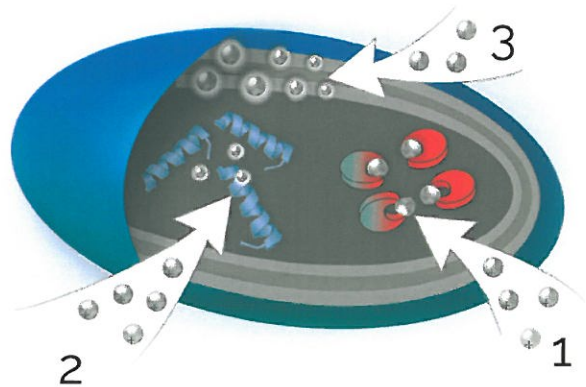
The advantage of the **SILVERPLUS®**-technology is that due to their relatively low solubility, silver ions are set free economically from a chemical equilibrium. Thus the important antimicrobial active ingredient is used very effectively, and resources are safeguarded.



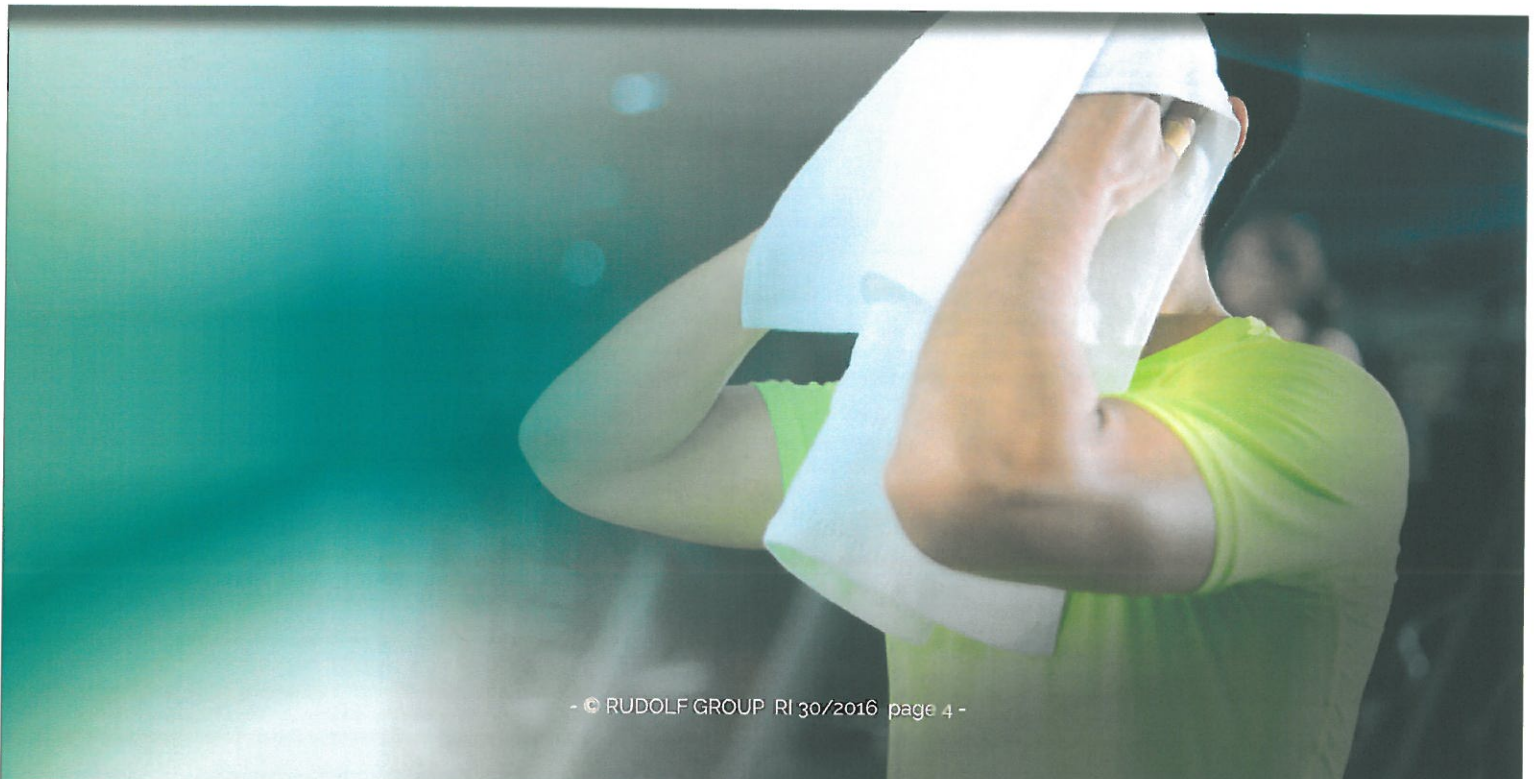
Equilibrium on the AgCl side

Effect mechanism

1. Blocking oxygen-transporting enzymes
2. Inactivating sulphur-containing proteins of the odour-causing bacteria
3. Locking the cell membrane



* This is not approved by the EPA and hence not valid for the USA.





ADVANTAGE ECOLOGY

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SILVERPLUS®

Fresh textiles even at low washing temperatures

1. Ecological textile care for the 21st century

Over their entire life span, significant amounts of energy for washing, tumble drying, ironing or mangling textiles are necessary in the professional or household textile care. The consumption of water and detergent is considerable and exceeds many times the quantities necessary for the textiles' production. With an increasing world population we will have reached our limits soon. Integral system optimisation is thus imperative.

SILVERPLUS® ecology: fresh textiles even at low washing temperatures – less energy consumption and better CO₂ balance

Heating water requires a lot of energy. To save energy the trend towards low washing temperatures continues. Today, detergent manufacturers promote washing temperatures of 20° - 40° C. In addition, due to material and colour, many textiles can only be washed at low temperatures. However, bacteria are only effectively removed at washing temperatures of ca. 60° C.

Thus, at low temperatures washing machines are an ideal breeding ground for bacteria. Instead of cleaning the laundry the opposite is achieved.

This becomes evident, above all, by the musty odour when drying laundry in poorly ventilated cellar rooms or when storing textiles in areas of high humidity. Sometimes even washing machines start diffusing musty odours.

SILVERPLUS® is the remedy; it confers hygiene and freshness to textiles, even at low temperatures. The laundry and the washing machine stay clean.

With **SILVERPLUS®** consumers save energy and money and contribute to environmental protection.

In the field of rental linen these advantages are even more significant as water and energy are saved. Fewer wash cycles increase the life span of textiles, and even the susceptibility to mildew spots can be minimised by the use of **SILVERPLUS®**.



ADVANTAGE
ECOLOGY

SILVERPLUS®
Ecology and efficiency

2. Efficiency: Extraordinary resistance to washing and dry cleaning

Due to its micropigmentation **SILVERPLUS®** anchors to textiles by itself in a resistant to washing and dry cleaning manner without the addition of chemical binder or adhesive systems.

SILVERPLUS® for example deposits in the yarn interstices and is permanently bonded to the substrate due to strong attractive forces. This procedure is comparable with the deposit of soot particles, which, even after repeated wash cycles, cannot be removed by standard detergents.


Thus, depending on the product quantity applied, the structure and composition of the textiles to be finished as well as on washing temperatures and mechanics, the attainable resistance to washing is outstanding.

Pure cotton fabric, finished with 5 g/l RUCO-BAC AGP, for example still shows **99.9% bacterial reduction** after 100 x 60° C wash cycles, according to test method ASTM-E2149-01 (Dynamic Shake Flask test method, 24 h contact/shaking time against staphylococcus aureus) conducted by an independent test institute (see also test report on the right).

If correctly applied, **SILVERPLUS®** will last a textile's life, which can even be prolonged by the silver finish and the simultaneous protection from odour-causing bacteria.

Test report, Porst & Partner GmbH - This study report has not been evaluated and approved by the U. S. EPA. Presentation of data should not be construed as a public health claim.

Page 1 of 3 pages of test report no. 619385 N of 2006-12-13



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Test report no. 619385 N
Testing of fabric samples for antimicrobial activity according to ASTM E-2149-01
Order no. AWE 011206 - FR
Arrival in lab: 2006-12-04; Period of analysis: 2006-12-04 - 2006-12-13
Head of microbiological department: Dr. Karim Lauer-Schuler
General note: Copying this test report is permitted only in agreement with the contracted lab. This report consists of 3 pages. The test method signed with * is not listed in the attachments of the accreditation certificate.




Test results

Test method: ASTM E-2149-01*
Parameter: test media: Staphylococcus aureus DSM 1104
incubation: 24 h at room temperature in 100 ml 1/8 Ringer solution
weighed sample: 2 g
Remark: Variations of the test method are underlined in accordance with client.

sample	Initial titer [cfu/ml]	titer after 24 h [cfu/ml]	titer reduction [%]	titer increase [%]
CO fabric, finished with 5 g/l RUCO-BAC AGP	3,3x10 ⁷	< 10	99,9	
CO fabric, finished with 5 g/l RUCO-BAC ALP	3,3x10 ⁷	< 10	99,9	
after 100 washes at 60 °C				
CO Terry sport, finished with 5 g/l RUCO-BAC AGP	3,3x10 ⁷	< 10	99,9	
CO Terry sport, finished with 5 g/l RUCO-BAC ALP	3,3x10 ⁷	< 10	99,9	
after 100 washes at 60 °C				
CO control fabric, without antimicrobial finish	3,3x10 ⁷	1,5x10 ⁷		44,7

Forst & Partner GmbH
Umweltanalytik • Wasserprüfung • Ingenieurwesen
Karim Lauer-Schuler
Head of microbiological department

Head Office: 90763 FÜRTH, 17028 about the
ISO/IEC 17025:2005 certified
laboratory accreditation
The accreditation is for the following
testing: analysis and evaluation

DEUTSCHES INSTITUT FÜR QUALITÄT UND UMWELTTECHNIK (DIQU) AN DER UNIVERSITÄT FÜRTH



SILVERPLUS®

No influence on biological purging during sewage treatment

3. Be on good terms with nature

The use of **SILVERPLUS®** has been shown to have no negative effects on the environment.

The quantities of silver which **SILVERPLUS®** returns to nature (ppb range) correspond to the average natural silver content of natural soil or rocks.

Due to sulphide-containing components, the antibacterial silver ions of **SILVERPLUS®** products are bonded within seconds in the waste water stream to absolutely insoluble silver sulphide (Ag_2S) and, thus, are no longer bio-available. The activity of the bacteria of biological purging during sewage treatment, however, is not inhibited. Examinations of the independent test institute LAUS-GmbH, Kirrweiler/Germany, have confirmed this (see also page 12).



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