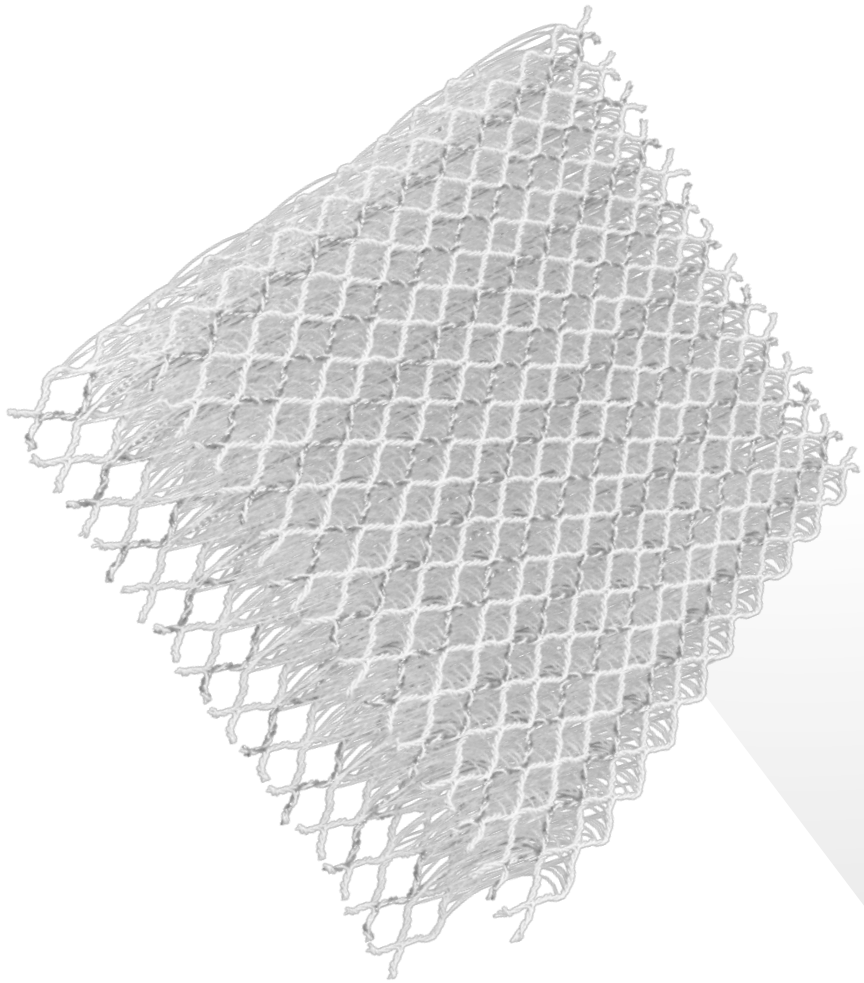
silvertex®

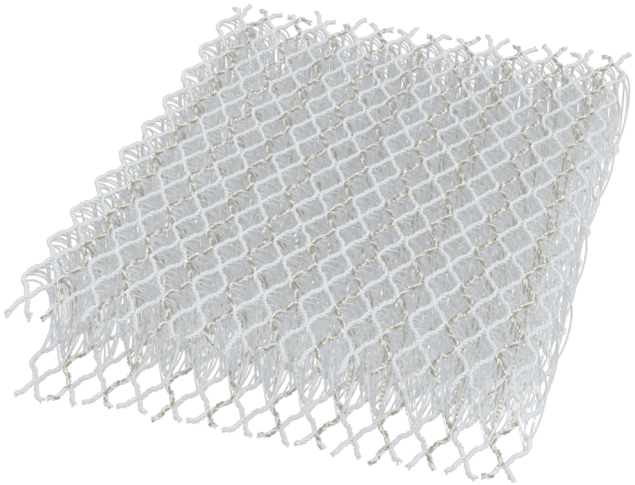
KEEPS WATER FRESH – SELF DOSING

WHAT IS SILVERTEX®?

- ✓ 3 dimensional knitted textile fabric with a defined amount of wet-chemically silvered threads
- ✓ effective protection against contamination of (drinking) water and technical fluids
- ✓ has an antimicrobial effect and sustainably reduces germ growth in (drinking) water and technical fluids
- ✓ prevents/reduces microbiological growth (biofilm formation)
- ✓ no energetic expenditure required
- ✓ self dosing silver ions offer long-term protection of up to 24 months



HOW DOES SILVERTEX® WORK?





Installation of the Silvertex® material in the tank/reservoir

Contact of the silvered threads with the surrounding oxygen-containing fluid

- Transfer of individual silver ions (Ag^+) into liquid (solvation)
- Uniform distribution of the silver ions (fluidisation)

HOW DOES SILVERTEX® WORK?





Over 30 proven mechanisms of action against germs and pathogens lead from

- metabolic disorders
- structural deformations
- inability to reproduce

...up to cellular death of the microorganisms

⇢ Oligodynamic effect

HOW IS THE **EFFECTIVE CONCENTRATION** ACHIEVED?

Natural water ingredients such as ions or variables such as pH value and hardness of the water limit the release of silver ions to the effective concentration.

EXAMPLE

Concentration of free silver ions in drinking water with natural chloride content (Cl^-), using the mass action law:

$$c(Ag^+) = 1{,}17 \times 10^{-10} / 1{,}3c(Cl^-)$$

CL^- [mg/l]	Ag^+ [µg/l]
10	50
20	25
.	.
60	8
.	.
100	5
.	.
200	2,5

ANTIBACTERIAL **EFFECT**

AGAINST HYDROPHILIC **GERMS & PATHOGENIC BACTERIA**

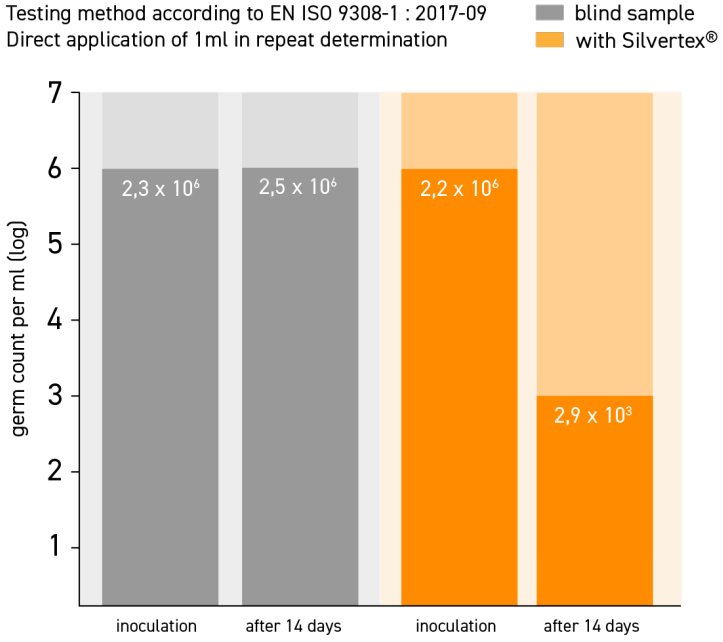
Test conditions

The tests were commissioned from GLU Gesellschaft für Lebensmittel- und Umweltconsulting mbH.

They were performed in accordance with Ph. Eur. 10.0, Methode 5.01.03.00 preservative exposure test „test for sufficient antimicrobial preservation".

Antibacterial efficacy
Experimental germ: coliforme germs

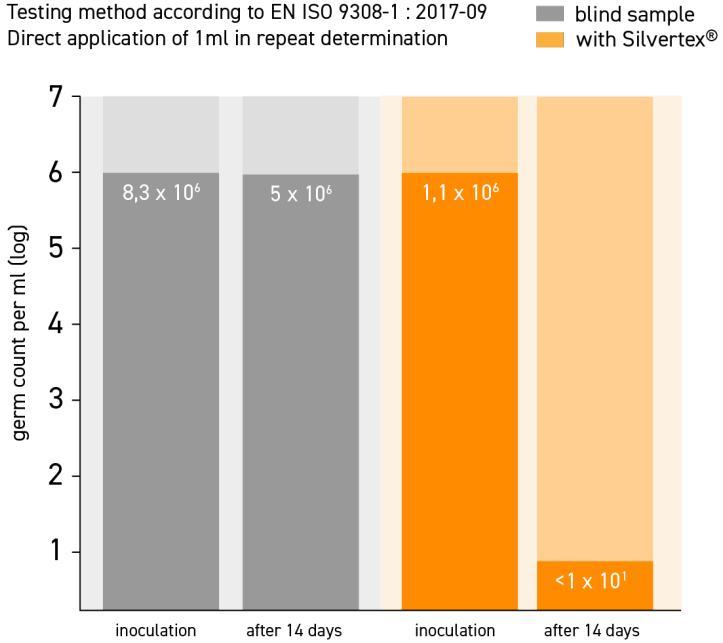
Testing method according to EN ISO 9308-1 : 2017-09
Direct application of 1ml in repeat determination



silver ion concentration Silvertex®-sample : Ø 27,6 µg/l

Antibacterial efficacy
Experimental germ: e.coli

Testing method according to EN ISO 9308-1 : 2017-09
Direct application of 1ml in repeat determination



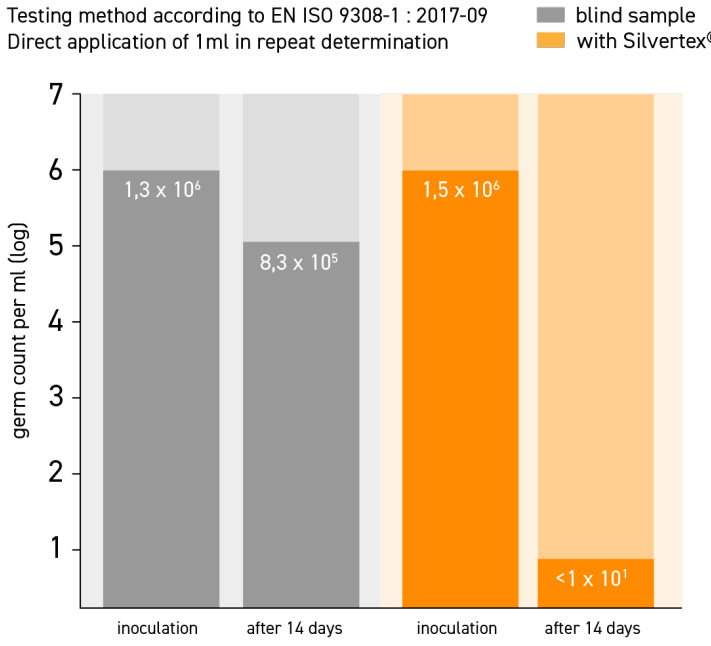
silver ion concentration Silvertex®-sample : Ø 30,1 µg/l

ANTIBACTERIAL **EFFECT**

AGAINST HYDROPHILIC **GERMS & PATHOGENIC BACTERIA**

Antibacterial efficacy
Experimental germ: enterococci

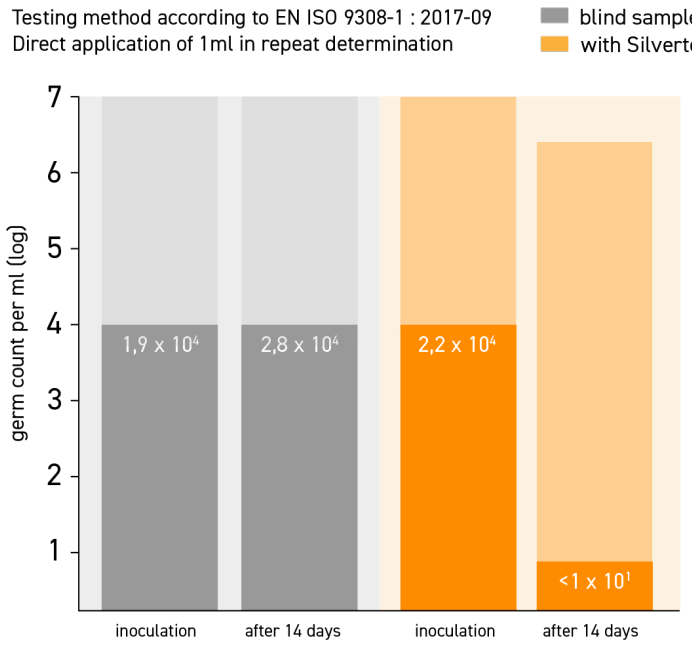
Testing method according to EN ISO 9308-1 : 2017-09
Direct application of 1ml in repeat determination



silver ion concentration Silvertex®-sample : Ø 28,5 µg/l

Antibacterial efficacy
Experimental germ: Legionella

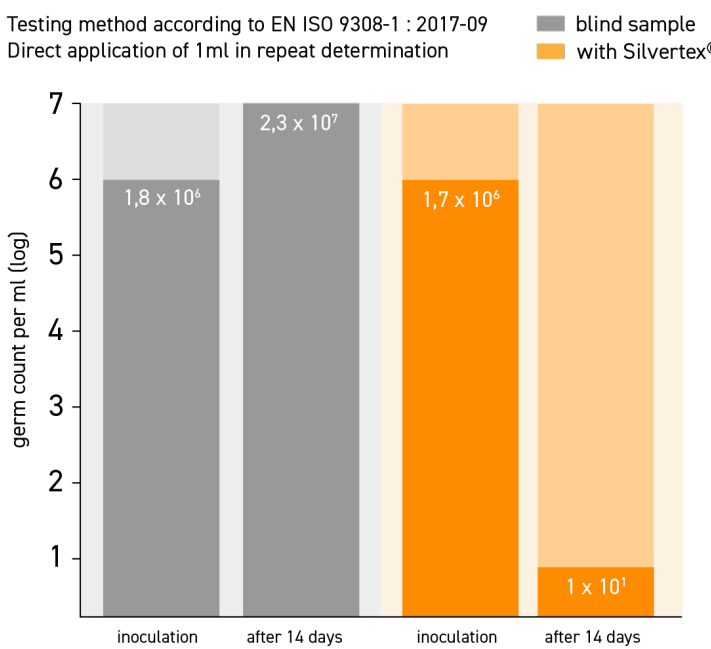
Testing method according to EN ISO 9308-1 : 2017-09
Direct application of 1ml in repeat determination



silver ion concentration Silvertex®-sample : Ø 29,1 µg/l

Antibacterial efficacy
Experimental germ: Pseudomonas aeruginosa

Testing method according to EN ISO 9308-1 : 2017-09
Direct application of 1ml in repeat determination

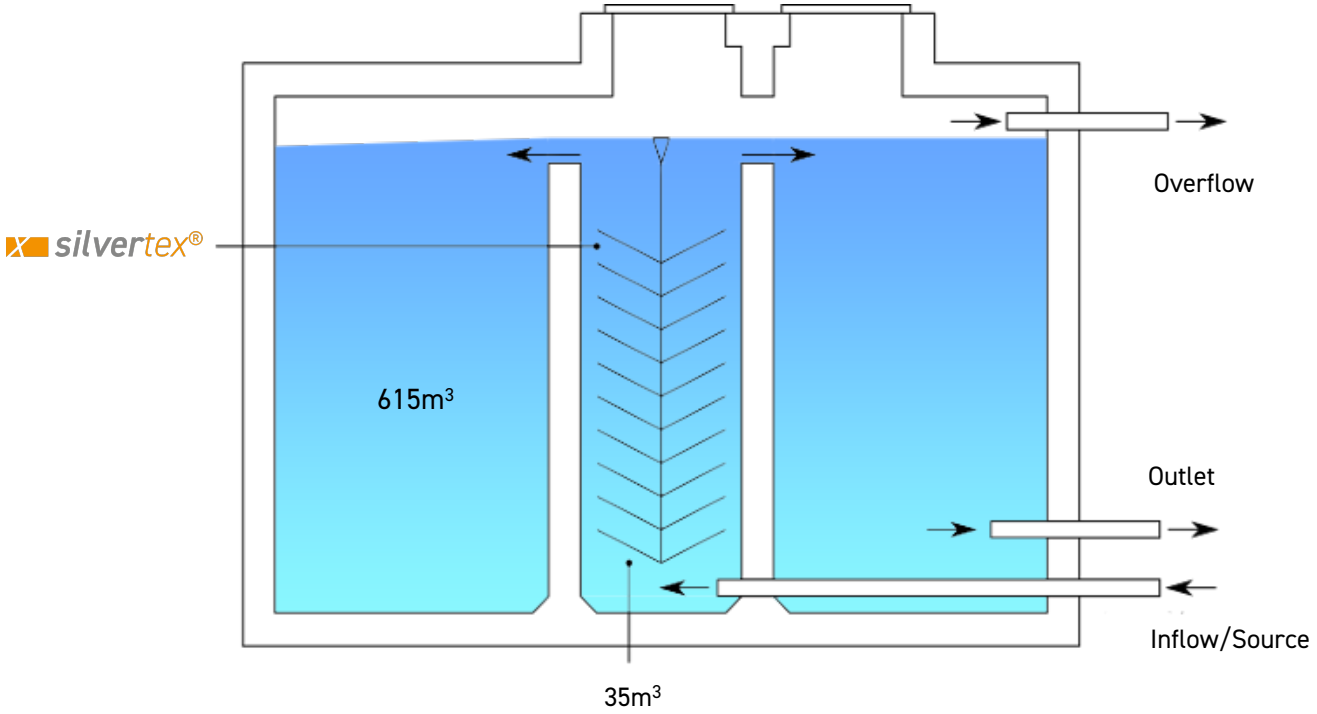


silver ion concentration Silvertex®-sample : Ø 33,1 µg/l

CASE STUDY: **ELEVATED DRINKING WATER RESERVOIR**

Raw water collected from alpine springs in the free inflow is fed into a high-altitude intermediate reservoir (700m³) and from there gravitationally fed into the local drinking water supply network. The microbial composition of the raw water (E. coli, coliforms, enterococci, clostridia, etc.) requires mandatory disinfection monitored by the competent authority.

Until the installation of the Silvertex® system (03.11.10), chlorine dioxide was used as a disinfectant. With the installation of Silvertex®, after break off the chlorine dioxide dosing. Since then, a total of approx. 20,000m³ of drinking water with an average content of <10µg Ag/L in officially controlled microbial quality (findings predominantly <1 CFU/100ml) has been provided during maintenance-free operation.



Schematic representation of the installation



Silvertex® Installation



Elevated drinking water reservoir

CASE STUDY: **ELEVATED DRINKING WATER RESERVOIR**

Microbiological results		Coliforms (CFU/100ml)	E.Coli (CFU/100ml)	Enterococci (CFU/100ml)	Clostridia (CFU/100ml)	Ag (µg/l)
3.11.10	Inflow/Source	13	2	4	3	-
	Outlet	29	6	8	7	-
4.11.10	Installation of Silvertex®					
7.11.10	Outlet	15	0	4	0	-
10.11.10	Outlet	1	0	4	0	3,2
17.11.10	Outlet	2	1	0	0	3,6
24.11.10	Outlet	2	0	0	0	4,0
30.11.10	Outlet	1	1	0	0	4,4
13.12.10	Outlet	0	0	0	0	6,0
17.01.11	Outlet	0	0	0	0	-
24.01.11	Outlet	0	0	0	0	10,2
28.02.11	Outlet	0	0	0	0	14,0

CASE STUDY: **DRINKING WATER TANK IN HOSPITAL**

As in many public facilities, the problem of legionella control in drinking water should not be underestimated. In addition to standardised thermal disinfection, the hospital tried to reduce the number of legionella by adding chlorine dioxide and using a UV lamp.

The number of Legionella before the installation of Silvertex® exceeded the prescribed limits (>10,000 CFU/ml) and the existing preventive methods were only successful in the short term. After the installation of the Silvertex® material (4.5m²) in a temporary storage tank (0.5m³), the legionella numbers dropped drastically.

As a precautionary measure, the hospital decided to run the dosing of chlorine dioxide in addition to Silvertex®, during the construction work (insulation of the pipes and installation of the taps). After completion of the work, the system was switched off so that only Silvertex® is still in operation. The legionella levels have dropped to below 10 CFU/ml (as of April 2018).



Water reservoir

IS **SILVER IN DRINKING WATER** A HEALTH CONCERN?

World Health Organization

The World Health Organization (WHO) recommends a maximum silver ion concentration of 0.1mg silver (100µg) per liter for the preservation of drinking water; this has been agreed upon internationally. So far, no scientific study can be reported that has demonstrated a harmful effect on the human organism in the above-mentioned concentrations. A report of the World Health Organization (WHO) shows that the value of 5 grams of ingested silver does not have a toxic effect in the human body, precisely because a large part is excreted again via the stool. Thus, even a lifetime consumption of 2 liters of drinking water per day, with the maximum recommended silver ion concentration of 0.1mg/liter of drinking water, does not pose any health risks [1]. Also, the cities of Atlanta, Denver or New York have always had natural silver levels of 200 – 300µg/l. Here, no adverse effects on the health of the affected population were found, even with continuous consumption of silver amounts in the above-mentioned concentration [2].

cen EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

The **European Standard EN 15030** [3] deals with the conservation of water. Here, **reference is made exclusively to the active ingredient silver(-ion)** when it comes to water preservation.

BfR
German Federal Institute for Risk Assessment

Excerpt from German Federal Institute for Risk Assessment [4] :"The BfR also took into account an unrealistic worst-case assumption in which a consumer drinks 2l of water per day from small-scale plants from the age of one to 70, whereby the maximum silver concentration of 0.080 mg/l (80µg) permitted after treatment is exhausted. **The BfR concluded that [...] there are no health concerns**."

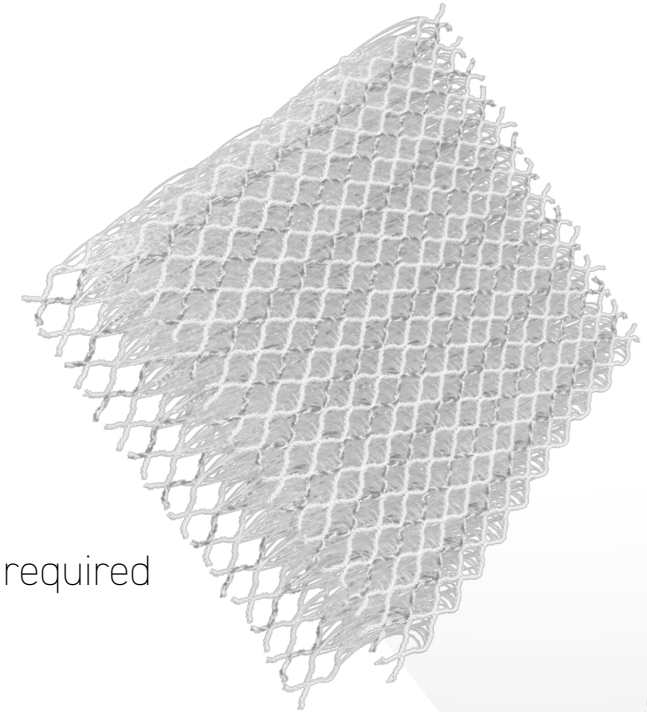
[1] Guidelines for drinking-water quality, 2nd ed. Vol. 2. health criteria and other supporting information. World Health Organization, Geneva, 1996

[2] Water Quality and Treatment, 2nd. ed., J Am. Water Works Association, New York 1951

[3] EN 15030:2012+A1:2015 Chemicals used for treatment of water intended for human consumption - Silver salts for intermittent use, 2015

[4] German Federal Institute for Risk Assessment, Statement No. 024 , 28 Dec. 2009

ADVANTAGES OF SILVERTEX®



- protects against microbial contamination
- prevents/reduces biofilm formation
- self dosing
- easy installation
- no maintenance effort
- no energetic expenditure required
- no formation of toxic by-products
- long-term effect of up to 24 months
- freely scalable product sizes (for reservoirs with 25l up to several hundred m^3 capacity)

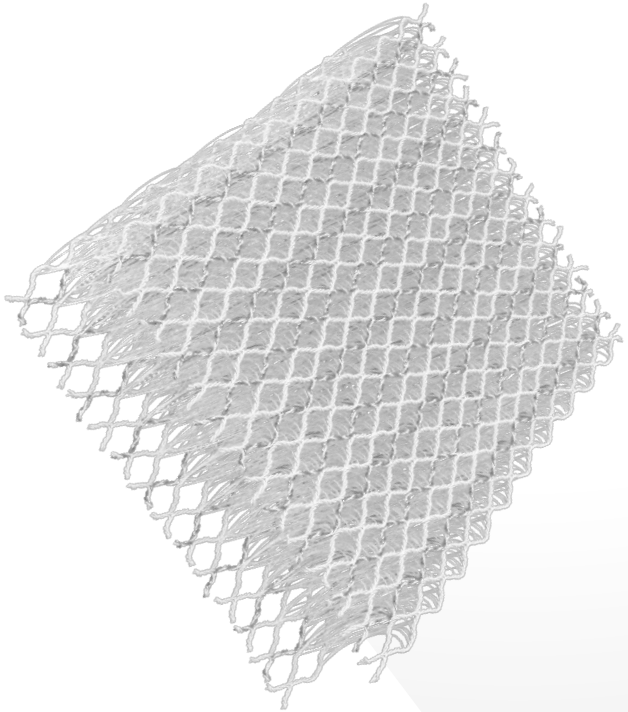
WHERE IS SILVERTEX® USED?

MOBILE USE

- ✓ trains, buses, planes
- ✓ motorhomes, caravans
- ✓ boats, yachts, houseboats
- ✓ mobile gastronomy
- ✓ water transport vehicles
- ✓ etc.

STATIONARY USE

- ✓ drinking water storage
- ✓ poultry farming
- ✓ process water (cooling circuits, cooling lubricant emulsions, etc.)
- ✓ plant engineering (e.g. air humidifiers/washers)
- ✓ water treatment plants
- ✓ etc.





...and everywhere else where water must be protected from microbiological contamination!

THANK **YOU**

silvertex®

KEEPS WATER FRESH – SELF DOSING

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