

Sub Zero Silver Protection

History of Silver

For centuries silver has been used successfully to fight microbial attack. In the past, silver coins were placed in earthen vessels to preserve milk. Today, the inside of refrigerators are made from silver-containing materials to meet hygienic requirements.

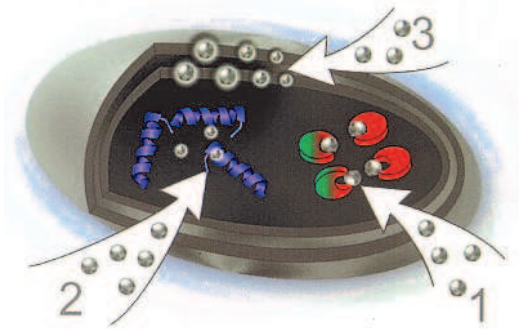
Hygiene & Micro-Organisms

Micro-organisms are microscopic life-forms that include bacteria and fungi. They require certain prerequisites to be able to exist, such as food, temperature and moisture. Textiles worn next to the skin such as underwear and socks are ideal biospheres for these micro-organisms.

How does Silver work?

Silver ions control bacteria by means of a triple mechanism:

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



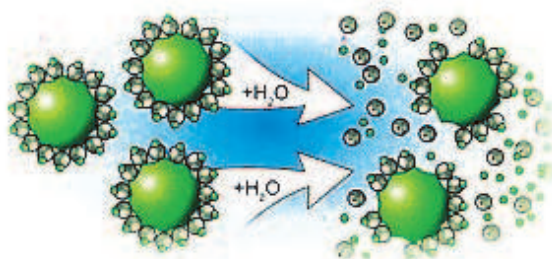
Basically they interfere with bacteria replication (which takes place every 20 minutes) thus in a relatively short space of time the bacterial count is greatly reduced.

What about resistance?

Bacteria cannot adapt to all three effective mechanisms and so cannot become resistant to silver

How does *Sub Zero Silver Protection* work?

The Silver ions are part of Silver Chloride which is carried by Titanium Dioxide. When in contact with moisture, the Silver Chloride releases the Silver Ions. This forms an equilibrium. Once Silver ions bond to microbes then more ions are released and the equilibrium is reformed. The release of silver depends wholly on the usage of silver by bacteria reduction.



Equilibrium of titanium dioxide, silver chloride and silver ions with antimicrobial effect in moist medium (e.g. perspiration)



How long does it last?

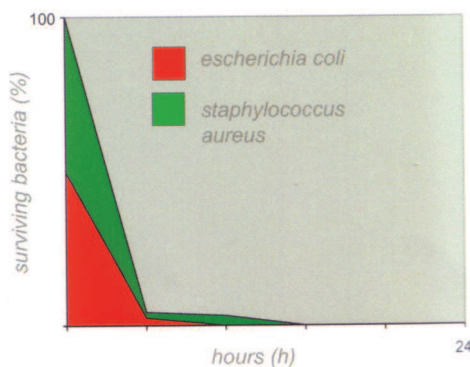
The equilibrium between Silver Chloride and Silver Ions occurs at very small quantities (stable at 3 parts per billion in solution). The large active surface of Silver Chloride means that the antimicrobial effects are virtually infinite.

How is it applied?

Sub Zero Silver Protection is applied to the fabrics during the dyeing process where it anchors itself to the yarn gaps making it permanently bonded. This makes the treatment resistant to washing and dry cleaning without affecting the handle of the fabric. We guarantee all our garments that have been treated with *Sub Zero Silver Protection* will be effective for up to 100 washes.

What does it protect against?

Sub Zero Silver Protection has been tested against many forms of bacteria with excellent results: In excess of 99.99% reduction on gram positive/negative bacteria, fungi, moulds and algae. It not only protects against microbe infection but also inhibits the growth of odour causing bacteria such as *staphylococcus aureus*.



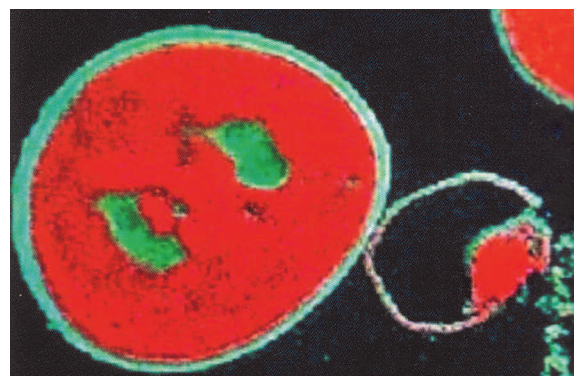
The antimicrobial/hygienic finish based on silver prevents the uninhibited multiplication of bacteria on textile surfaces. Already in the first two hours *Sub Zero Silver Protection* shows an antimicrobial effect of 95%.

Dynamic Shake Flask test (ASTM-E2149-01)

The following are just a selection of bacteria that have been tested and successfully controlled with *Sub Zero Silver Protection*:

MRSA – Methicillin Resistant *Staphylococcus aureus*

Salmonella enteritidis
Aspergillus nidulans
Aspergillus amstelodami -
Aspergillus niger
Mucor racemosus
Trychophyton mentagrophytes
Penicillium chrysogenum
Myceliophthora thermophila
Saccharomyces cerevisiae
Candida albicans
Clostridium difficile
Corynebacterium spp
Corynebacterium minutissimum
Enterobacter gergoviae
Escherichia coli
Escherichia coli 0157 H7
Klebsiella pneumoniae
Listeria monocytogenes
Mesophilic aerobes
Proteus mirabilis
Pseudomonas cepacia



Methicilline-resistant staphylococcus aureus
(MRSA, resistant stem)

