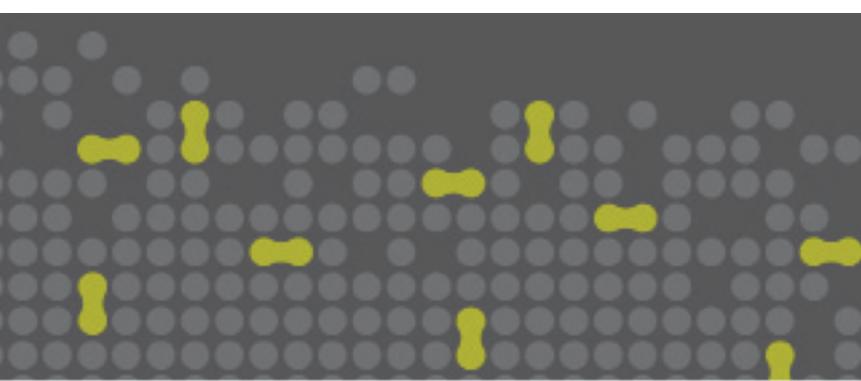




antimicrobial additives



# BactiBlock® antimicrobial additives

## Product description

BactiBlock® is an antimicrobial additive for polymer-based raw materials. The proprietary and patent-pending BactiBlock® technology is based on silver-functionalized clay that creates a naturally sourced and highly efficient antimicrobial product.

The additive prevents the growth of bacteria, mold, fungus and other microorganisms, which also makes BactiBlock® a powerful tool against odors and stains.

The active ingredient in BactiBlock® is ionic silver (Ag), a naturally occurring element with a well-known antimicrobial spectrum, as well as being widely recognized as safe for human contact.

## How does it work? Why silver?

**Silver** is a broad-range antimicrobial agent that has been proven effective against most harmful microorganisms present in everyday life, such as *E.coli*, *Legionella*, *Pseudomonas*, *Salmonella*, *S. aureus*, *Aspergillus niger* among others.

Silver prevents microbial growth by interaction with essential components in the microbial cell membranes, altering their barrier properties and thereby preventing the entry of nutrients or causing the leakage of intracellular content.

## Bacterial Resistance and Silver

One of the first things to discuss when considering an antimicrobial surface solution is to determine which type of solution to use to avoid bacterial resistance.

With increasing drug-resistance and growing concern regarding the over-prescribing of antibiotics, there has been a resurgent interest in the use of antimicrobial silver. Unlike antibiotics, silver appears to be immune to resistance (Chopra I et al., 2007). The reason is due in large part to silver's multi-pronged approach to killing infection-causing bacteria.

Antibiotics are typically microorganism and site specific—each one effective against a particular type of bacteria and single-minded in its method of attack. Penicillin for instance, kills bacteria by

interfering with cell wall synthesis; sulfonamides act by disrupting folic acid synthesis. As the bacterium multiplies, mutations naturally occur. Eventually a cell may be produced that is not affected by the antibiotic's single form of attack. These mutated cells then multiply until a completely new resistant strain begins to spread. The more antibiotics are used, the greater the chance that resistant strains develop and proliferate.

Silver, on the other hand, is a broad-spectrum, multi-site antimicrobial. Ionic Silver not only disrupts folic acid synthesis, but it also disrupts protein synthesis, inhibits DNA synthesis, disrupts electron transport and interferes with cell wall synthesis. This multi-pronged attack makes almost impossible for the bacteria to mutate in a way that would lead to resistance (Percival S.L., 2005).

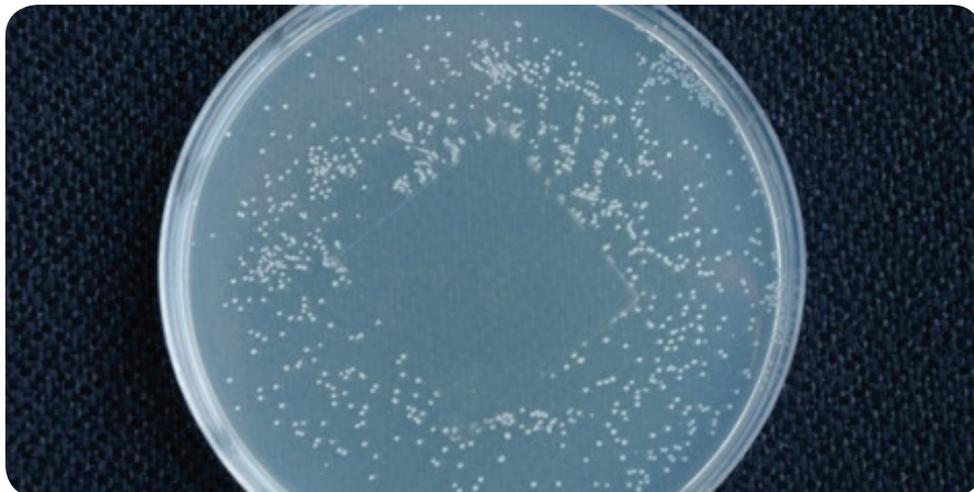
# BactiBlock® antimicrobial additives

## Testing of antimicrobial activity

The antimicrobial activity of materials containing BactiBlock® is typically tested using the standard protocol for surface antimicrobial activity JIS Z 2801, which is equivalent to ISO 22196:2007. Depending on the specific application, other tests are also

routinely carried out, such as ASTM E2149 and NC-CLS.

These tests can be carried out internally in the NanoBioMatters laboratories or alternatively certified through external testing facilities.



*Petri Plate containing a film with antimicrobial BactiBlock®, inhibited bacterial (E. coli) growth on the film*

## Engineered Clay + Silver Synergies

The most innovative aspect of the BactiBlock® additive is that purified and modified phyllosilicate clay is used as performance-enhancing carrier of the silver antimicrobial agent. This creates strong synergies between the two materials, especially in terms of efficiency and durability.

During the proprietary production process, ionic silver is linked to the clay surface, obtaining a uniform

distribution of the active species within the additive. In addition, the silver deposited on the clay prevents platelet agglomeration, which ensures global additive dispersion. The combination of these dispersion mechanisms maximizes antimicrobial efficiency and homogenous protection of the polymer material.



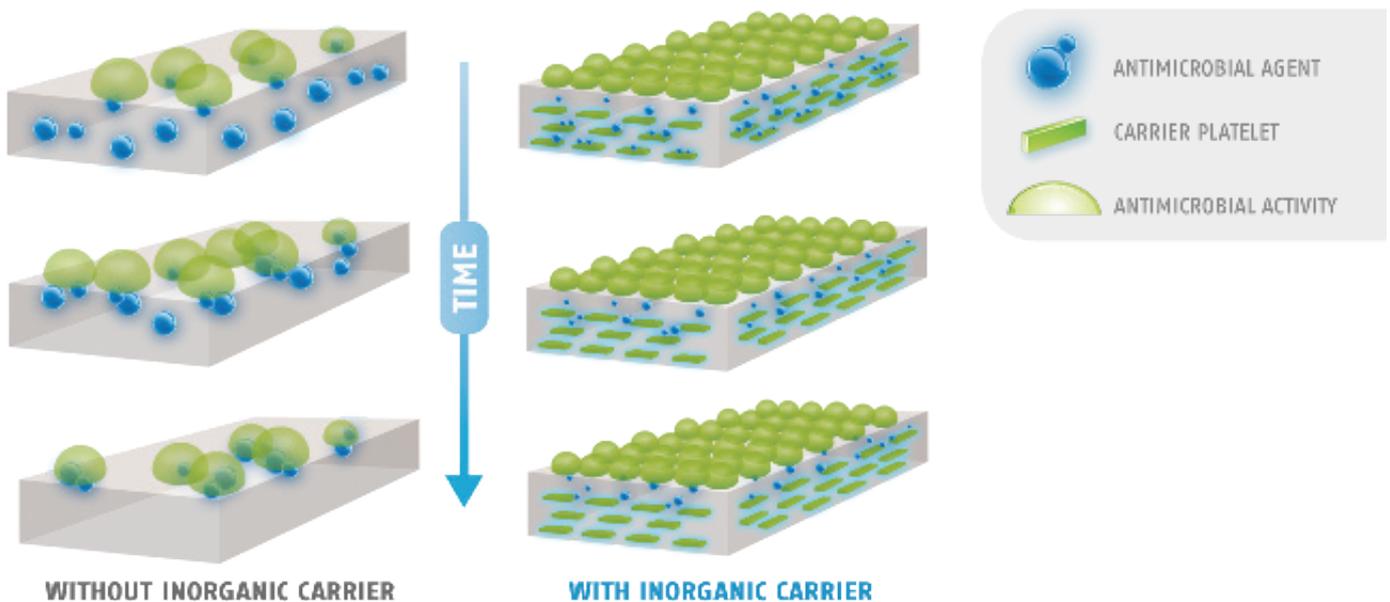
# BactiBlock<sup>®</sup> antimicrobial additives

## Durability. The longer lasting solution

The silver species linked to the clay platelets are released to the surface of the protected material at a controlled rate. This ensures a more uniform and long term antimicrobial effect, compared to additives with the active species readily available in the polymer.

BactiBlock<sup>®</sup> is therefore ideally suited for long term applications and although durability in most cases depends on wear and environmental conditions (temperature and humidity), the antimicrobial performance can be expected to endure for several years.

### HIGH DISPERSION AND CONTROLLED RELEASE



The major advantage of the BactiBlock<sup>®</sup> additives is that the clay carrier works as a highly efficient delivery system for silver ions. This ensures that BactiBlock is highly cost competitive, combined with long term durability and exceptional polymer compatibility.



# BactiBlock® antimicrobial additives

## Product range

The BactiBlock® range is versatile and includes products that are compatible with a wide range of polymers. New solutions are continuously being developed for additional systems.

The product is delivered as a micronized powder or a masterbatch.

The major component of each BactiBlock® grade is functionalized clay, combined with a low concentration of antimicrobial agent. The specific levels of each component can be tuned to achieve the desired performance. Final concentration of the total additive package is highly dependent on product design and target properties.

### BactiBlock® grades and recommended dosing\*

	101 R1.43 %	101 R1.47 %	101 S1.19 %	101 R4.47 %	920 B Series %
<b>THERMOSETS</b>					
Epoxy based	-	1,0 - 1,5	0,5 - 1,0	0,5 - 1,0	0,3 - 0,5
Polyester based	-	1,0 - 1,5	0,5 - 1,0	0,5 - 1,0	0,3 - 0,5
<b>THERMOPLASTICS</b>					
Polypropylene	0,5 - 2,0	-	-	-	0,5 - 1,0
Polyethylene	0,5 - 2,0	-	-	-	0,5 - 1,0
Polystyrene	0,5 - 2,0	1,0 - 2,0	-	0,5 - 1,0	0,5 - 1,0
PA	0,5 - 2,0	1,0 - 2,0	0,5 - 1,0	0,5 - 1,0	***
PVC	0,5 - 2,0	1,0 - 2,0	-	0,5 - 1,0	***
PHB	1,0 - 2,0	-	-	1,0 - 2,0	***
<b>ELASTOMERS</b>					
EVA	1,0 - 2,0	-	-	0,5 - 1,0	***
<b>COATINGS/PAINTS</b>					
Solvent Based	0,25 - 1,0**	0,25 - 1,0**	-	0,2 - 0,5**	***
Water Based	0,25 - 1,0**	0,25 - 1,0**	-	0,2 - 0,5**	***
Powder coatings	-	-	-	-	0,5 - 1,0

\*New solutions are continuously being developed for additional systems.

\*\* Also available in aqueous or solvent based gel form with 33% additive to improve dispersion and handling.

\*\*\* 920B Series is a new grade resistant to high temperatures with a maximum to 600°C .

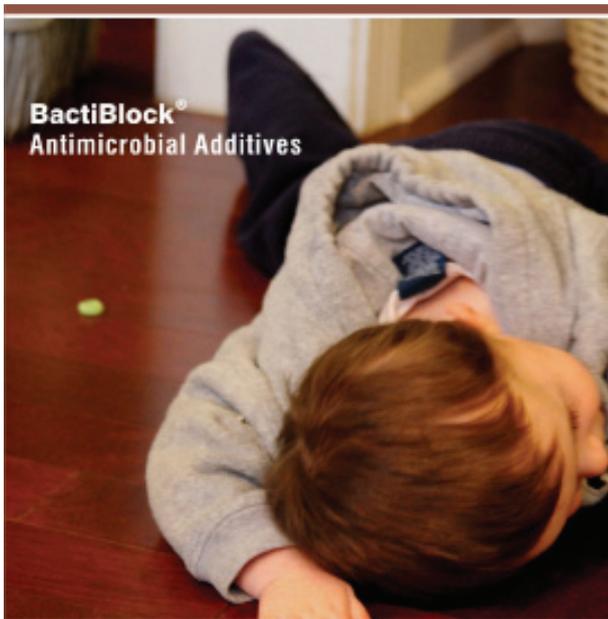
Please, contact NBM for information on your specific system.

# BactiBlock<sup>®</sup> antimicrobial additives

## BactiBlock<sup>®</sup> Applications

Because silver is considered not to be harmful to humans, animals or plants, antimicrobial BactiBlock<sup>®</sup> can be used in a wide range of applications where hygiene, odor control and stain resistance are main objectives. Due to the high versatility, durability and efficiency of the product, applications are found in a wide range of sectors:

- Construction (ventilation systems, flooring, tile joints, countertops, etc.)
- Office Accessories (furniture, pens, staplers, etc.)
- Electronics (hardware, castings, coatings, etc.)
- Apparel & Sports (textiles, shoe soles, mats, etc.)
- Healthcare (personal care and medical devices)
- Food (packaging, coatings, processing and vending machine, etc.)



### Protect your surfaces and materials

BactiBlock<sup>®</sup> is an antimicrobial additive for polymer-based new materials. The proprietary and patent-pending BactiBlock<sup>®</sup> technology is based on silver-functionalized clay that creates a naturally sourced and highly efficient antimicrobial product. The additive prevents the growth of bacteria, mold, fungus and other microorganisms, which also makes BactiBlock<sup>®</sup> a powerful tool against odors and stains.

#### Bacterial Control



## Key Facts

- Solution to achieve a higher level of hygiene.
- High efficiency against pathogen organisms present in hospital acquired infections: *E.coli*, *S.aureus*, *Salmonella sp*, *Listeria sp*, etc.
- Built in, long lasting protection of products and surfaces.
- Product approval by EPA/FDA and other international associations.
- Additives based on cutting-edge technology.
- Efficient control systems of critical points and problems of cross contamination.
- Value added product DIFFERENTIATED from competitors.

# BactiBlock<sup>®</sup> antimicrobial additives



**Apparel & Sports**



**Office accessories**



**Construction**

