



BactiBlock® as antimold



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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.

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.

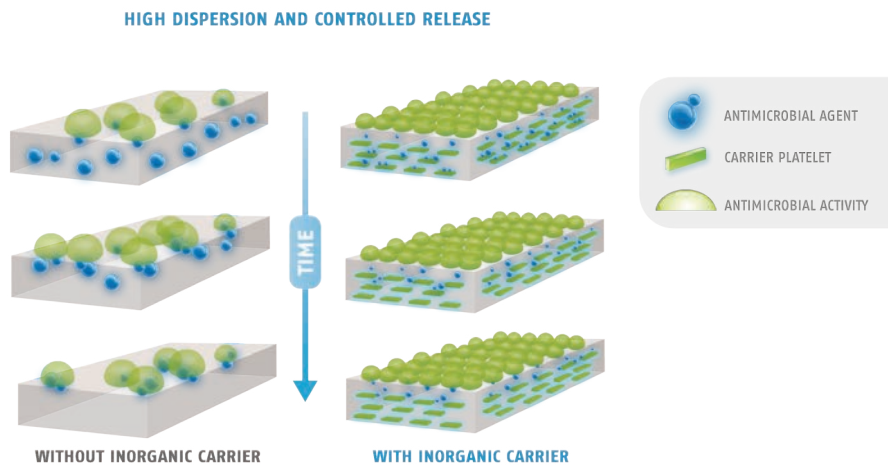


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Durability. The longer lasting solution

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.

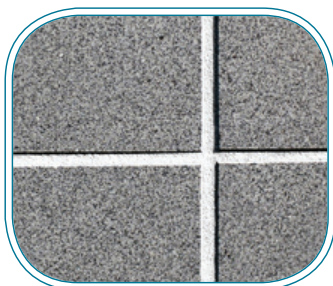
BactiBlock® is therefore ideally suited for long term applications and although durability in most cases depends on wear and environmental conditions (temperature and humidity), the antimicrobial performance can be expected to endure for several years.



BactiBlock® Applications

Because silver is considered not to be harmful to humans, animals or plants, antimicrobial BactiBlock® 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.)



Construction



Office Accessories / Electronics



Apparel & Sports / Healthcare

BactiBlock® as antimold

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 %
THERMOSETS					
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
THERMOPLASTICS					
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	***
ELASTOMERS					
EVA	1,0 - 2,0	-	-	0,5 - 1,0	***
COATINGS/PAINTS					
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 .

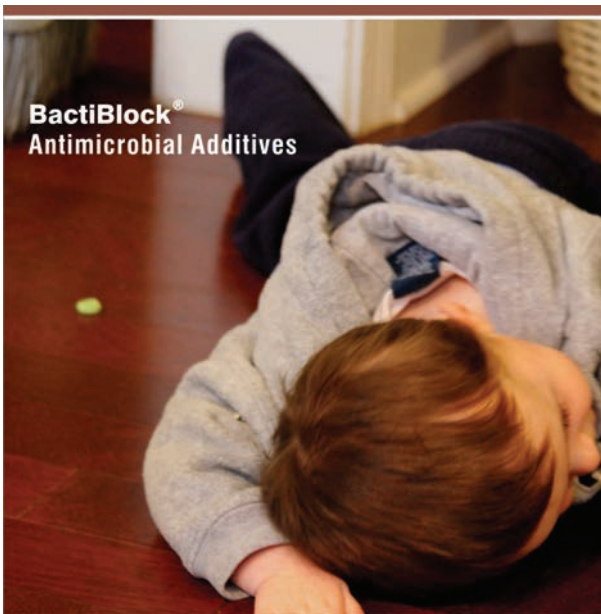
Please, contact NBM for information on your specific system.

BactiBlock® as antimold

BactiBlock® Applications

Because silver is considered not to be harmful to humans, animals or plants, antimicrobial BactiBlock® 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:

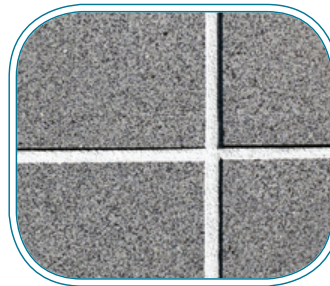
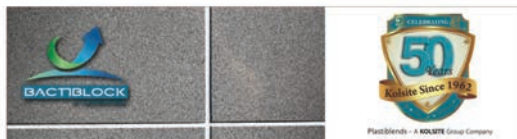
- Construction (ventilation systems, flooring, tile joints, countertops, etc.)
- Office Accessories (furniture, pens, staplers, etc.)
- Electronics (hardware, castings, coatings, etc.)
- Apparel & Sports (textiles, shoe soles, mats, etc.)
- Healthcare (personal care and medical devices)
- Food (packaging,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



Protect your surfaces and materials

BactiBlock® 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.

Bacterial Control



Construction



Office Accessories / Electronics



Apparel & Sports / Healthcare



BactiBlock® as antimold

BactiBlock® as Antifungal

Fungi include yeast, mold and mushrooms. Molds are fungi that grow in the form of multicellular filaments called hyphae. When mold spores are present in large quantities, they can present a health hazard to humans, potentially causing allergic reactions and respiratory problems.

Since many fungicides (such as vinclozolin) are dangerous to human health, agents from natural resources are preferred. BactiBlock is a silver-based antimicrobial product.

The antifungal activity of BactiBlock samples was evaluated according to Macrodilution method stipulated by the Clinical and Laboratory Standards Institute (CLSI). For this method, 0.1 g of BactiBlock was suspended in 10 mL of peptone water. Subsequently, a pure microbial culture was inoculated to obtain an initial concentration of 1×10^5 CFU/mL. Samples were incubated at 30°C for 24 h. Final microbial counts were determined by serial dilutions and plate count method in MEA. The test were carried out at an external accredited laboratory (Control Microbiológico)

Antimicrobial results against the growth of *Aspergillus niger* (CECT 2574; mold)

Sample	CFU/mL	CFU/mL	CFU/mL	Mean	R	%Microbial reduction
Control	3,20E+06	3,80E+06	3,30E+06	3,43E+06	-	-
BB 101 R1.43	10	10	10	1,00E+01	5,54	100,000
BB 101 R1.47	10	10	10	1,00E+01	5,62	100,000
BB 101 S1.19	4,80E+04	5,00E+04	4,70E+04	4,83E+04	1,94	98,84

Antimicrobial results against the growth of *Candida albicans* (CECT 1394;yeast)

Sample	CFU/mL	CFU/mL	CFU/mL	Mean	R	%Microbial reduction
Control	3,40E+06	4,70E+06	4,40E+06	4,17E+06	-	-
BB 101 R1.43	10	10	10	1,00E+01	5,62	100,000
BB 101 R1.47	10	10	10	1,00E+01	5,62	100,000
BB 101 S1.19	4,30E+04	4,50E+04	4,00E+04	4,27E+04	1,99	98,98

TEST CONCLUSIONS

BactiBlock® showed high effectiveness against the growth of *Aspergillus niger* and against the growth of *Candida albicans*.

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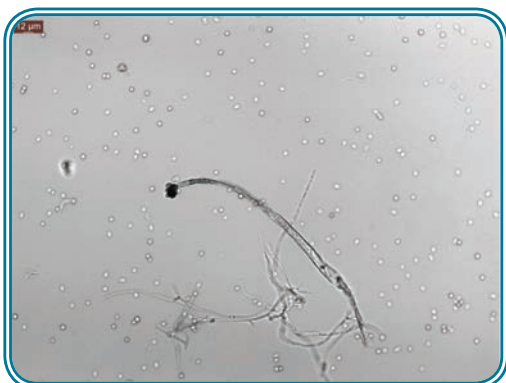
The antifungal properties of BactiBlock have been demonstrated in silicone samples according to the ISO 846 where the effect of fungi on polymeric materials is evaluated. The ISO 846 test uses visual examination along with the measurement of mass and physical properties changes if necessary. The ISO 846 is a norm to test both fungi and bacteria in relation to plastics and polymers, important because microorganism actions can impact the quality of plastic products. For this method, the surface of a polymer test piece was placed onto the surface of a complete agar plate and seeded with the microorganism (concentration 1×10^5 CFU). After inoculation, the plates were incubated at 25°C, 95% RH for 4 weeks.



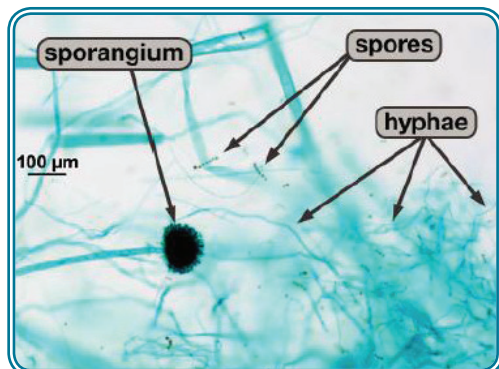
Control silicone sample piece without BactiBlock®: We observe the fast growth of *Aspergillus niger* after 4 weeks



Silicone sample piece with 3% BactiBlock® 101 R1.47: We observe the high effectiveness of the additive against mold.



Aspergillus niger observed by optical microscopy 1: We observe mold growth in silicone sample piece without BactiBlock®.



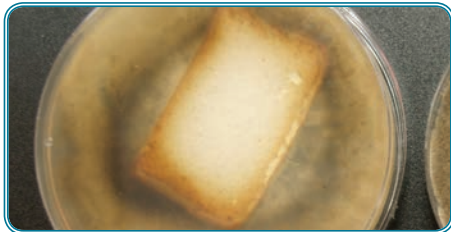
Aspergillus niger observed by optical microscopy 2: We observe the form of grown multicellular filaments and spores, potentially health hazards.



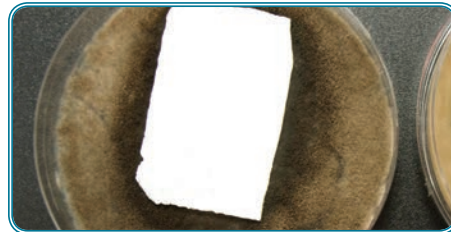
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BactiBlock® Antimold properties in several applications

BactiBlock® in paints:

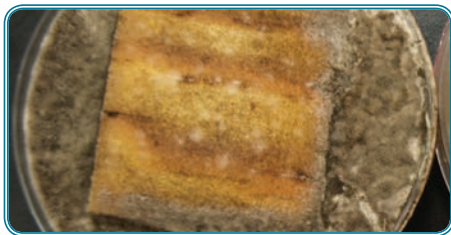


*Paint sample sheet without BactiBlock® additive:
Mold growth is observed on the painted sheet*



*Paint sample sheet with 1.5% BactiBlock® R1.47:
Mold growth on the painted sheet is not observed*

BactiBlock® in coatings:

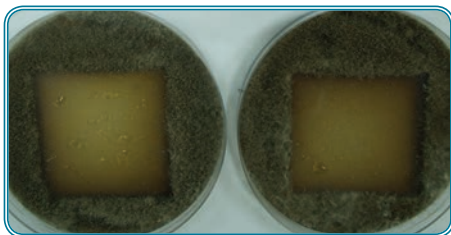


Wood sample piece without coated BactiBlock®

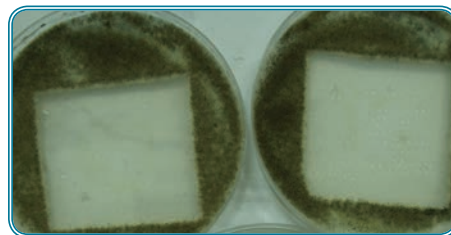


*Wood sample piece with coated BactiBlock® R1.47:
Efficient coating against Aspergillus Niger*

BactiBlock® in PET:

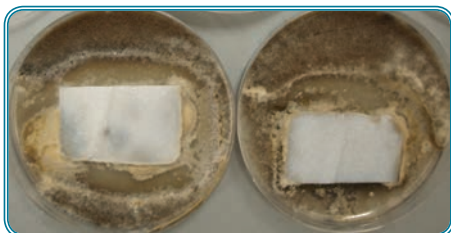


PET sheet without BactiBlock® additive



*PET sheet s with 2% BactiBlock® R1.47: Efficient solution
against mold growth in plastic applications*

BactiBlock® in silicones for ceramic joints:



Silicone samples without BactiBlock® additive



Silicone samples with 3% BactiBlock® R1.47



BactiBlock® as antimold

The standard 846 includes different methods (A, B and C) to test the material's resistance to microbial attack.

- **Method A:** evaluates the inherent resistance of the material to fungi attack (5 species) in the absence of any other organic matter.
- **Method B:** evaluates the antifungal properties of the material. A complete medium used in which the microorganisms will be able to develop, so that growth inhibition will be observed if the material exhibits antimicrobial activity.
- **Method C:** evaluates the material's resistance to bacterial growth (specifically, *Ps. Aeruginosa*)

METHOD A: Test of fungal growth (incomplete medium)

1) Samples:

- Size recommended: thickness of 500 microns to 2 millimeters
- All samples must be the same size
- Batch Samples:
 - Lot 0: control samples stored at standard temperature and humidity conditions
 - Lot I: samples inoculated with microorganisms and incubated
 - Lot S: sterile samples incubated under the same conditions as the lot/batch I.
- It should be done 5 samples per batch/lot
- Sterilize the samples with 70% ETOH if appropriate.

2) Procedure:

- Prepare Petri Dishes with 5 mm thickness of incomplete agar
- Prepare a spore solution, centrifuge and adjust to a concentration of 1×10^6 CFU / mL
- Inoculate 0.1 ml of the spore suspension on the sample I
- Pie Out 3 mL of 70% ETOH on the sample S
- Incubate at 24–29°C for 4 weeks

METHOD B: Test of fungal growth (complete medium)

- as method A but with complete medium

METHOD B¹: Test of fungal growth (complete medium)

- as the method B but the samples are placed after the fungi have grown on the board but have not esporulated (2 or 3 days)



BactiBlock® as antimold

SUMMARY OF METHODS:

	Test with fungi							Tests with bacteria		Tests with soil			
Method	A		B		B ¹			C		D			
Subclause	8.2.1		8.2.2		8.2.2.7			8.2.3		8.2.4			
Medium used	Incomplete agar medium (5.2.3.4)		Complete agar medium (5.2.3.5)		None			Complete agar medium (5.2.3.5)		Mineral-salt agar (5.3.2.3) inoculated as specified in 8.2.3.5		Soil (see 5.4)	
Batch	I	S	I	S	I	I	S	I	S	I	S		
Solution sprayed on specimen*	Sp-S	Ms-S	Sp-S	Ms-S	Sp-S	Sp-S	Ms-S	Sp-S	Ms-S	Sp-S	Ms-S		
Incubation conditions	24°C±1°C or 29°C±1°C							29°C±1°C or 29°C±1°C					
	4 weeks or more:							>95% relative humidity**					

*Sp-S = spore suspension; Ms-S = microbicidal solution

**This humidity is reached by the agar medium in methods A, B, B¹ and C. For method D, the incubator shall have a controlled relative humidity of at least 95%.

Incomplete Medium

NaNO₃ : 2,0g
 KH₂PO₄ : 0,7 g
 K₂HPO₄ : 0,3 g
 KCl : 0,5 g
 MgSO₄.7H₂O: 0.5 g
 FeSO₄.7H₂O: 0.01 g
 Agar: 20 g
 Distilled water: 1 liter

Complete Medium

NaNO₃ : 2.0 g
 KH₂PO₄: 0.7 g
 K₂HPO₄: 0.3 g
 KCl: 0.5 g
 MgSO₄.7H₂O: 0.5 g
 FeSO₄.7H₂O: 0.01 g
 Agar: 20 g
 Glucose: 30 g
 Distilled water: 1 liter

JIS Z 2801 STANDARD:

BactiBlock effectiveness as antimold against *Aspergillus niger* and *Candida albicans* has been also tested according to the JIS Z 2801 Standard in Control Microbiológico (External Laboratory).



Note: Antimold effectiveness can be also tested according to the new Standard JIS Z 2911:2010, which is based on the following international standards:

ISO 846: 1997, Plastics-Evaluation of the action of microorganisms.

ISO 9022 - II: 1994, Optics and optical instruments - Environmental test methods - Part II: Mould growth

IEC 60068 - 2-10: 2005, Environmental testing - Part 2-10: Tests - Test J and guidance: Mould growth

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JIS 2911 Standard

The JIS Z 2911: 2010 standard deals with fungus, but for the moment it is only available in Japanese (it has not been still translated into English). What is available in English is the JIS Z 2911: 1992 but can only be purchased by fax from Japan, not online, and is more than 20 years old and thus is outdated.

JIS Z 2911:2010, has been based on the following standards:

- ISO 846: 1997, Plastics–Evaluation of the action of microorganisms.
- ISO 9022 – II: 1994, Optics and optical instruments – Environmental test methods – Part II: Mould growth
- IEC 60068 – 2-10: 2005, Environmental testing – Part 2-10: Tests – Test J and guidance: Mould growth

Evaluation of the antifungal activity of BactiBlock® samples (0,1 g/10mL TSB)

Antimicrobial results against the growth of *Aspergillus niger* (CECT 2574; mold)

Sample	CFU/mL	CFU/mL	CFU/mL	Mean	R	%Microbial reduction
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Antimicrobial results against the growth of *Candida albicans* (CECT 1394; yeast)

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BB 101 S1.19	4,30E+04	4,50E+04	4,00E+04	4,27E+04	1,99	98,98

BactiBlock® as antimold

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 SIAA, the Japanese International Association for Antimicrobial Products.
- Additives based on cutting-edge technology.
- Efficient control systems of critical points and problems of cross contamination.
- Value added product DIFFERENTIATED from competitors: good dispersion, higher effectiveness, durability and certified antibacterial and antimold function.

