

BacShield™

A Truly Unique Anti-microbial

What is BacShield™?

- BacShield is an EPA-registered anti-microbial utilizing ***chitosan*** as it's active ingredient
- As with many anti-microbial products, BacShield is registered under the “treated articles exemption”

BacShield

- Inhibits the growth of odor-causing organisms and prevents their reproduction
- Provides residual effect as long as present on the treated material

What is Bac-Shield™?

- The active ingredient in *BacShield™* is *chitosan*. *Chitosan* is made from snow crab shells, an *abundant* and *replenishable* natural resource.



What is Chitosan?

- Deacetylated derivative of *chitin*, the main component in crustaceans such as crabs, shrimp and squid
- 2nd most abundant polysaccharide on Earth, after cellulose



Chitosan Manufacturing Process

Crab Shells



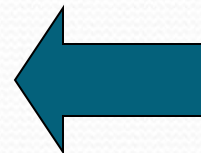
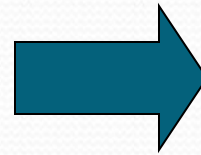
Chitin



Chitosan



Powdered Chitin



Environmental Impact

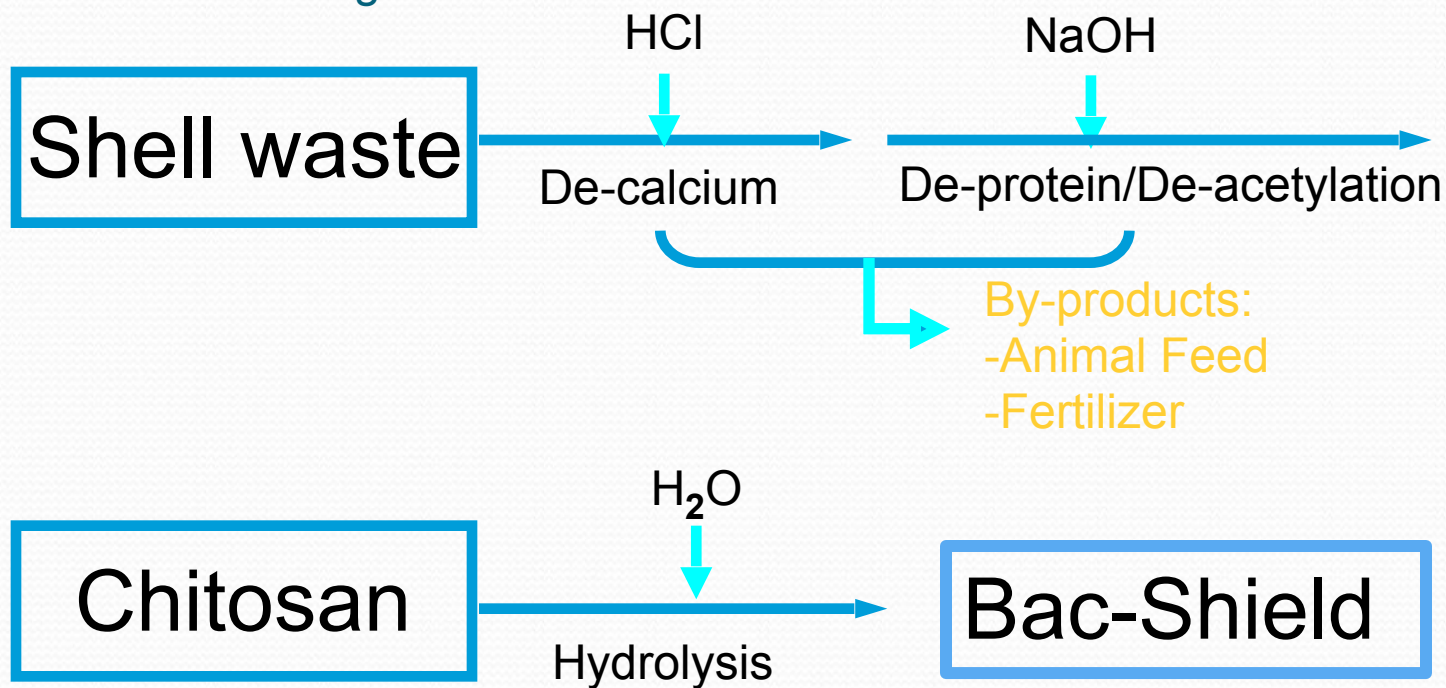
Chitosan:

- Abundant and sustainable resource
- Biocompatible
- Biodegradable
- Low potential for toxicity
- *“It is estimated that approximately 1% of the shell fish waste produced globally is actually utilized for chitin and chitosan production.”*

-Excerpt from “Polysaccharides and Polyamides in the Food Industry” 2005

By A. Steinbuchel, Sang Kikhee

Chitosan Manufacturing Process



Chitosan Manufacturing Process

- Two by-products: protein and calcium
 - Protein used in animal feed
 - Calcium used in fertilizer
- Two production chemicals:
 - Hydrochloric acid and sodium hydroxide are neutralized to form “salt water”.



BacShield - Toxicity

- All EPA-registered products are assigned a **toxicity category** as seen on following slide.



or



EPA Toxicity Categories

Most Toxic

Least Toxic

| Study | Category I | Category II | Category III | Category IV |
|-------------------------|--|--|---|--|
| Acute oral | Up to and including 50 mg/kg | >50 through 500 mg/kg | >500 thru 5000 mg/kg | >5000 mg/kg |
| Acute dermal | Up to and including 200 mg/kg | >200 through 2000 mg/kg | >2000 thru 5000 mg/kg | >5000 mg/kg |
| Acute inhalation | Up to and including 0.05 mg/liter | >0.05 through 0.50 mg/liter | >0.50 thru 2.00 mg/liter | >2.00 mg/liter |
| Primary eye irritation | Corrosive (irreversible destruction of ocular tissue) or corneal involvement or irritation persisting for more than 21 days. | Corneal involvement or other eye irritation clearing in 8-21 days. | Corneal involvement or other eye irritation clearing in 7 days or less. | Minimal effects clearing in less than 24 hours. |
| Primary skin irritation | Corrosive (tissue destruction into the dermis and/or scarring) | Severe irritation at 72 hours (severe erythema or edema) | Moderate irritation at 72 hours (moderate erythema) | Mild or slight irritation at 72 hours (no irritation or slight erythema) |
| Signal words for labels | DANGER | WARNING | CAUTION | None Required |

Bac-Shield™

Bac-Shield Safety

- After BacShield has been applied and dried...*chitosan*, a remarkably safe, versatile substance remains, as used in products such as...

Current Uses of Chitosan

Nutritional supplements



Cosmetics & shampoos



Military medical bandages

Stop severe bleeding fast



CEL+X Saves Lives

Water purification



Bac-Shield™ Safety

- Bac-Shield is hypoallergenic...it will not trigger shellfish allergic reactions.
 - The proteins which cause these reactions have been removed.
 - The carbohydrate portion is used in Bac-Shield.



EPA's Assessment of Chitosan

Excerpts taken from:

“Docket Number: EPA-HQ-EPA-”...

“Chitin and Chitosan Summary Document
September 2007”



EPA's Assessment of Chitosan

Description of the Active Ingredients:

...”Chitosan has several biomedical applications. It is considered to be a hemostatic agent that is hypoallergenic and is known to possess antibacterial properties.



EPA's Assessment of Chitosan

Ecological Risk Assessment:

“Ecological effects for both Chitin and Chitosan ... these active ingredients posed negligible to non-existent ecological risk.”



EPA's Assessment of Chitosan

Human Health:

...”Moreover, all the data reviewed by the Agency indicate that both Chitin and Chitosan are so low in toxicity as to be considered virtually non-toxic to humans or animals....”



EPA's Assessment of Chitosan

“A July 2003 summary memo notes the following toxicological profile for the sole end-use product, *Chitosante (BacShield)*:

Acute Dermal Toxicity, Acute Oral Toxicity, Acute Inhalation Toxicity and Skin Irritation are accepted as Toxicity Category IV;

Acute Eye is accepted as Toxicity Category III; and Chitosante is deemed a Non-sensitizer.”...



Bac-Shield™

Effectiveness

Bac-Shield™ Lab Tests

- Laboratory tested according to AATCC and ASTM industry standard test methods.
- Demonstrated effectiveness against odor-causing bacteria, mold, mildew and other fungi.

Bac-Shield™ Lab Tests

AATCC Test Method 174

Combination of 147,100,30

VA&G

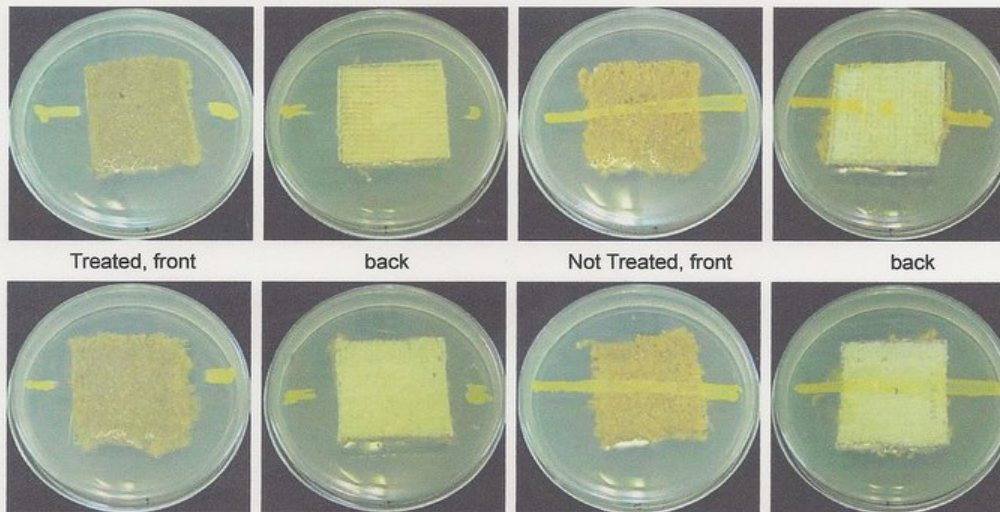
2
REPORT NUMBER: TR090619-1

CHEM-TEX ID: 147

RESULTS:

AATCC 174- part I

Staphylococcus aureus, ATCC No. 6538



| Sample | Growth | Inhibition zone | Evaluation of the antimicrobial effect |
|--------------------------------|--------|-----------------|---|
| Treated, front | Nil | Width=4 mm | Good effect, pronounced inhibition zone |
| back | Nil | Width=6 mm | Good effect, pronounced inhibition zone |
| Not Treated, front | Medium | Width=0 mm | Insufficient effect |
| back | Medium | Width=0 mm | Insufficient effect |
| Treated- 1 GSA wash, front | Nil | Width=4 mm | Good effect, pronounced inhibition zone |
| back | Nil | Width=6 mm | Good effect, pronounced inhibition zone |
| Not Treated- 1 GSA wash, front | Medium | Width=0 mm | Insufficient effect |
| back | Medium | Width=0 mm | Insufficient effect |

Part I:
Qualitative test for
gram-positive
and
gram-negative
bacteria

Bac-Shield™ Lab Tests

AATCC Test Method 174

Combination of 147,100,30



4
REPORT NUMBER: TR090619-1

CHEM-TEX ID: 147

AATCC 174- part II

Staphylococcus aureus, ATCC No. 6538

| Sample Identification ¹ | CFU/ml at "0" time contact | CFU/ml after "24 hrs." contact | Percent reduction R% ² |
|------------------------------------|----------------------------|--------------------------------|-----------------------------------|
| Control sample | 2.5×10 ⁵ | 3.4×10 ⁷ | - |
| Treated | 1.5×10 ⁵ | <100 | >99.9% |
| Not Treated | 1.7×10 ⁵ | 1.4×10 ⁷ | NR |
| Treated- 1 GSA wash | 1.0×10 ⁵ | <100 | >99.9% |
| Not Treated- 1 GSA wash | 1.9×10 ⁵ | 6.4×10 ⁶ | NR |

Klebsiella pneumoniae ATCC No. 4352

| Sample Identification ¹ | CFU/ml at "0" time contact | CFU/ml after "24 hrs." contact | Percent reduction R% ² |
|------------------------------------|----------------------------|--------------------------------|-----------------------------------|
| Control sample | 2.0×10 ⁵ | 1.1×10 ⁸ | - |
| Treated | 1.2×10 ⁵ | 2.6×10 ⁴ | 87.0% |
| Not Treated | 1.8×10 ⁵ | 9.5×10 ⁷ | NR |
| Treated- 1 GSA wash | 1.5×10 ⁵ | 2.4×10 ⁴ | 88.0% |
| Not Treated- 1 GSA wash | 1.6×10 ⁵ | 1.0×10 ⁸ | NR |

- 1 piece of swatches with 48mm in diameter.
- The percent reduction was calculated by the formula:

$$R\% = 100(B-A)/B \%$$
 where
 A = the number of bacteria recovered from the samples after "24 hours" contact.
 B = the number of bacteria recovered from the samples at "0" time contact.
- NR=No Reduction.
- The control sample is an untreated cotton specimen (VA&G).

Part II:
Quantitative test for
gram-positive
and
gram-negative
bacteria

Bac-Shield™ Lab Tests

AATCC Test Method 174

Combination of 147,100,30

VA&G

2

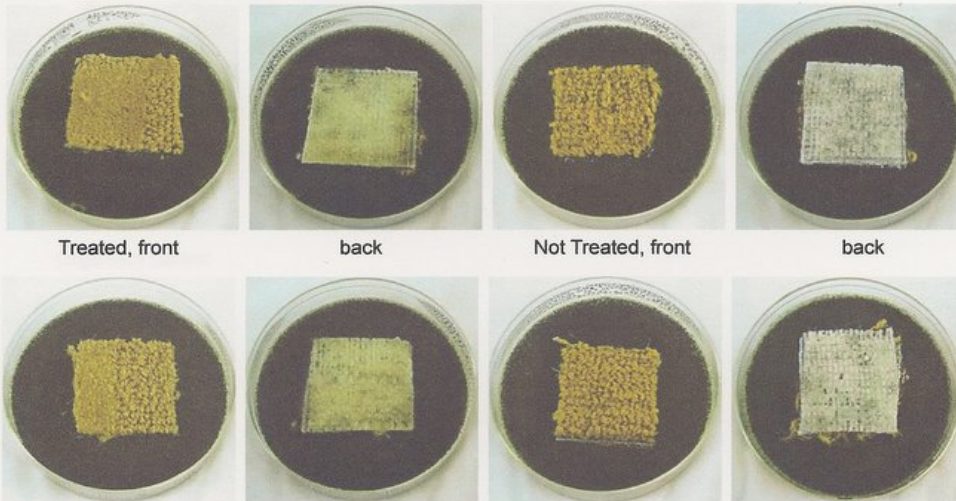
REPORT NUMBER: TR090619-2

RESULTS:

CHEM-TEX ID: 147

AATCC 174- part III

Aspergillus niger, ATCC No. 6275



Treated, front

back

Not Treated, front

back

Treated-1 GSA wash, front

back

Not Treated-1 GSA wash, front

back

| Sample | Growth | Inhibition zone | Evaluation of the antifungal effect |
|--------------------------------|-----------------|-----------------|-------------------------------------|
| Treated, front | Nil | Width=0 mm | Good |
| back | Over 80% growth | Width=0 mm | Unsatisfactory |
| Not Treated, front | Over 80% growth | Width=0 mm | Unsatisfactory |
| back | Over 80% growth | Width=0 mm | Unsatisfactory |
| Treated- 1 GSA wash, front | Nil | Width=0 mm | Good |
| back | Over 80% growth | Width=0 mm | Unsatisfactory |
| Not Treated- 1 GSA wash, front | Over 80% growth | Width=0 mm | Unsatisfactory |
| back | Over 80% growth | Width=0 mm | Unsatisfactory |

The organism control was >99.9% growth at 28°C, 90% R.H. for 7days

Part III:
Visual test
for fungi

Effectiveness in the Field

Synthetic Turf... Putting Green in North Georgia.

Before Treatment



One Year After Cleaning / Treatment



Effectiveness in the Field

Vinyl Siding

Before Cleaning and Treatment



15 Months After Treatment



Effectiveness in the Field



Indoor and Outdoor
Synthetic Playing
Surfaces



Effectiveness in the Field



Carpet and Upholstery,
Indoors and Outdoors



Effectiveness in the Field



New Construction



Effectiveness in the Field



Existing Construction



Bac-Shield™

Application

Bac-Shield Properties

- Light to dark amber liquid
- Cationic...should not be mixed with strong anionics
- pH of 4.5-5.5...solutions containing BacShield should remain below pH of 7.0
- Non-flammable
- Not explosive

Application of Bac-Shield

BacShield can be applied by:

- Foam
- Mist
- Spray
- Immersion

Application of Bac-Shield

General Application Parameters

- Apply BacShield as the final finish or, in conjunction with other compatible finishes (non-ionic or cationic materials) as the final finish
- Surface of treated materials should be completely covered via spray, soaking, or other application methods
- BacShield coating should be thoroughly dried before use

Application of Bac-Shield

Application on Synthetic Turf

- One gallon of BacShield concentrate will cover 5233 sq. ft. of turf
- Mix BacShield with water at any concentration suitable for spraying equipment being used for application

Example

- Mix 12 ounces of BacShield per gallon of solution (12 oz BacShield + 116 oz. water)
- Apply as a spray
- One gallon of this solution will cover approximately 490 sq. ft. of turf

Note:

One football field, sideline to sideline (53.3 yd.)...end zone through end zone (120 yd) will require approximately 11 gallons of BacShield

Application of Bac-Shield

Application on Infill for Synthetic Turf

- All surface area of the infill should be thoroughly coated with BacShield solution (6-12 oz. BacShield/ gallon of solution)
- Thoroughly dry treated material before installation
- Application can be done by spray, submersion, or other appropriate methods

BacShield...

The Sensible choice