ConBlock MIC

Antimicrobial Additive for
Microbial Induced Corrosion Defense

Product Submittal Package©

2015

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Table of Contents

Definitions

Acidithiobacillus: An acid excreting bacteria genus that lives when proper environmental conditions occur. Acidithiobacillus can be found in various pH conditions in a diverse range of media, including: mining soils, oil fields, confined aquifers, wastewater, concrete, and steel.
Also known as: Thiobacillus

Commonly referenced species:

- *Acidithiobacillus thioparus*
- *Acidithiobacillus intermedius*
- *Acidithiobacillus novellus*
- *Acidithiobacillus neapolitanus*
- *Acidithiobacillus thiooxidans*

Aerobic Bacteria: Bacteria living above the waterline, in the oxygenated crown of a wastewater system. This submittal mainly focuses on the acid producing Acidithiobacillus bacteria genus.

Anaerobic Bacteria: Bacteria living below the waterline of a wastewater system, within the effluent. Mainly focusing on sulfur reducing bacteria, which produce hydrogen sulfide.

Biofilm: The biological slim layer on the concrete surface where microorganisms live, including bacteria.

Microbial Induced Corrosion (MIC): The biogenic corrosion of concrete that occurs when environmental conditions allow bacteria to live on the concrete surface and produce corrosive concentrations of sulfuric acid.
Also known as: Biogenic Sulfide Corrosion

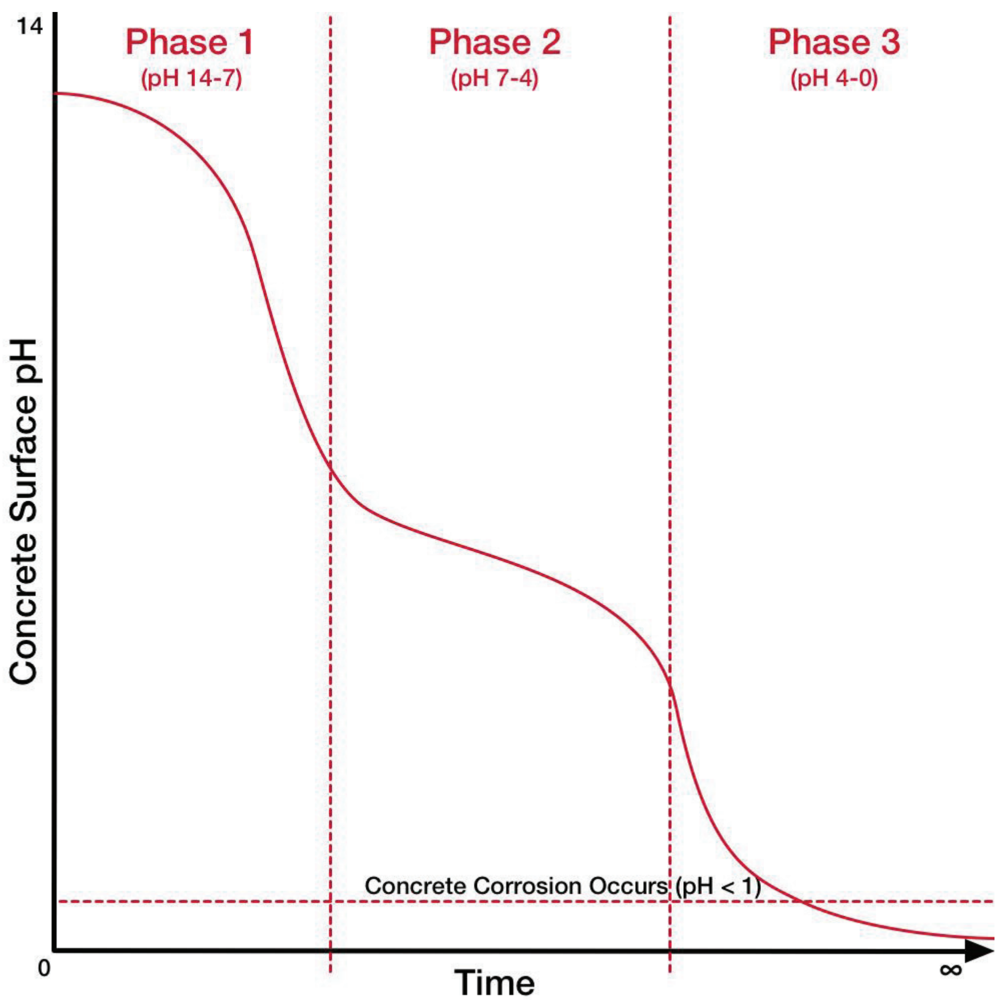
Manufacturer: The manufacturer is defined as the entity that manufactures and supplies the antimicrobial concrete admixture.

Producer: The producer is defined as the entity using the antimicrobial concrete admixture in concrete, concrete products, or mortar mixes.

The performance history of underground infrastructure supports concrete's long and reliable service in wastewater systems. Concrete sewer pipes unearthed after centuries of use have been found in good condition. The sustainable and resilient attributes of concrete are why concrete is the most widely used product for wastewater systems worldwide. However, the alkalinity of concrete leaves it susceptible to an acid attack under unique biogenic conditions known as microbial induced corrosion.

What is MIC?

Microbial induced corrosion, commonly referred to as MIC, is the biogenic process of microorganisms corroding concrete – most commonly found in concrete wastewater systems. When environmental conditions allow, the Thiobacillus species of bacteria thrive and MIC to occurs in a defined, 3-phase chain of events. This chain of events must take place before corrosion of concrete starts.

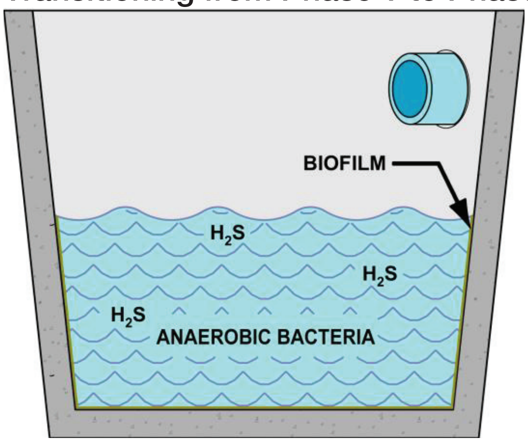


A graphical depiction of the different phases of Microbial Induced Corrosion.

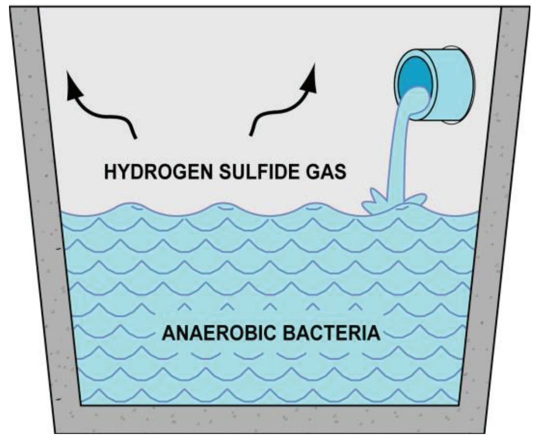
The MIC Chain of Events

The phases of MIC can be broken down into separate pH ranges of the concrete surface. The **first phase** of carbonating the concrete surface starts immediately after production of the concrete. This natural process only needs to affect the thin layer at the surface to allow the start of phase two – the growth of a biofilm.

Transitioning from Phase 1 to Phase 2

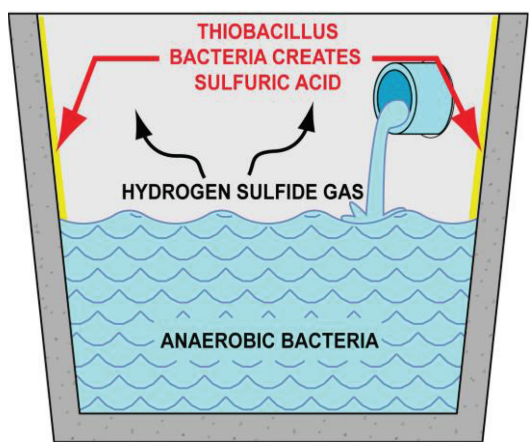


During the transition from phase one to phase two, the anaerobic bacteria convert sulfates into sulfides. These sulfides form hydrogen sulfide gas in the wastewater.



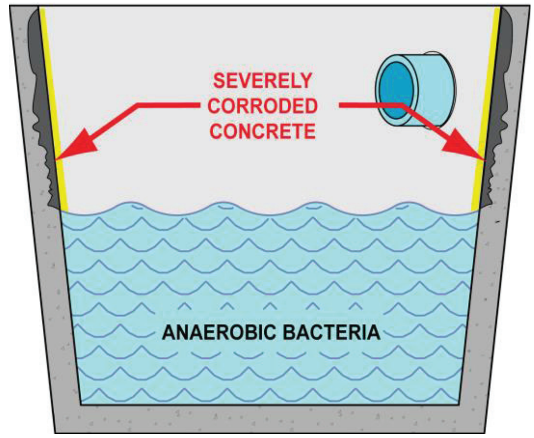
Formally in phase two, turbulence in the wastewater system releases hydrogen sulfide gas into the aerobic environment, which becomes valuable nutrients for Thiobacillus bacteria.

Phase two, the biofilm phase, provides the necessary colonization of organisms for harmful Thiobacillus to inhabit the concrete surface. The first species of Thiobacillus excrete weak acids by consuming available hydrogen sulfide gas and oxygen in the aerobic environment of the wastewater system. The excreted acid helps lower the concrete surface pH, enabling Thiobacillus species that produce stronger acids to inhabit the biofilm. This process continues well into phase three, where concrete deterioration occurs.



Thiobacillus can survive on concrete with a pH of 9 or lower. Turbulence releases hydrogen sulfide from the wastewater providing a source of food for the Thiobacillus.

Phase three, the deterioration phase of MIC, is only possible if phase two occurs. Starting around a pH of 4, habitation of Thiobacillus species that excrete stronger concentrations of acid begins the deterioration of the concrete surface. Severe corrosion occurs as the concrete surface pH drops below 1. The damage occurs when the excreted sulfuric acid reacts with the free lime (calcium hydroxide) forming calcium sulfate, also known as gypsum. The gypsum reacts with the alumina in the concrete to form ettringite, which expands in the presence of moisture. This expansion causes the concrete to crack and spall, thus allowing for deeper penetration of acid and continuance of the damaging cycle.



Damaging levels of corrosion begin to occur when the concrete surface pH drops below 1.

Common environmental attributes for MIC to occur

- Bacteria/Biofilm
- Low dissolved oxygen in wastewater
- Sulfates in the effluent
- Warm temperatures
- Turbulence
- Moisture on the walls above the waterline
- Reactive compounds in concrete
- Low effluent flow

How to tell if your system may have been a victim of MIC

MIC produces rough concrete surfaces showing loss of mortar or aggregates along with general spalling of the concrete. Damaged concrete surfaces can become soft to the touch, with missing aggregate and a gel-like texture at the concrete surface. One of the first indications of MIC is the appearance of a white mass above the waterline in a concrete wastewater system. This white formation is the gypsum formed in the reaction between the biogenic sulfuric acid and calcium hydroxide.


Example of MIC in a wastewater system.

ConBlock MIC

Antimicrobial Concrete Admixture / Surface Treatment

Microbial Induced Corrosion Defense for Concrete Sanitary Systems

The ConBlock MIC Treatment

As a concrete treatment, ConBlock MIC is extremely effective against mold, fungi, algae and damaging bacteria. Unlike sacrificial or leaching chemistries, the technology of ConBlock MIC controls microorganisms with a chemistry that remains a permanent part of the concrete structure. The active ingredient in ConBlock MIC – *3-(trihydroxysilyl) propyldimethyloctadecyl ammonium chloride* - relies on a charged ion and a unique spiked molecular structure to create an uninhabitable environment for the microorganisms. These molecular spikes are undetectable to human touch, but overmatch single-cell organisms. In nature, most microbes carry the opposite ionic charge so they are physically and irresistibly drawn into contact with ConBlock MIC, which punctures the cell walls of the offending microbes.

ConBlock MIC vs. Thiobacillus Bacteria

The species of bacteria responsible for the biological corrosion of concrete caused by Microbial Induced Corrosion is Thiobacillus. In the proper conditions, several strains of Thiobacillus exist. As the Thiobacillus thrives, it lowers the pH of the concrete surface, creating an optimum environment for the next, more damaging Thiobacillus strain to inhabit the concrete. When tested against the damaging Thiobacillus bacteria, ConBlock MIC shows great success *(See Back for Test Results)*. Without the bacteria that generate the damaging sulfuric acid, the concrete is protected from Microbial Induced Corrosion.

In the Mix and On the Surface

- Antimicrobial treatment permeates the entire concrete when added in the mix, protecting inside and out.
- The treatment cures into a cross-linked polymer, bonding with the aggregate and cement to impart durable protection.
- The antimicrobial polymer that is formed causes the microbe cell walls to break upon contact, keeping the surface free of excess bacteria and mold buildup.
- The treatment does not migrate out of the concrete.
- ConBlock MIC is EPA registered and labeled for concrete and stone applications.
  - This antimicrobial product has provided safe and effective treatment for over 30 years.

Physical Properties

- Color: Clear
- Odor: None
- Density: 8.3 lbs/gal
- pH: 3.8
- Actives Content: 3.6%
- Volatile Content: <1.0%
- **EPA Registration No.: 64881-7-87907**

Don't Just Seal It, ConSeal It!

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ISO 9001 Registered

ConBlock MIC

Antimicrobial Concrete Admixture / Surface Treatment

CONSEAL
CONCRETE SEALANTS INC.

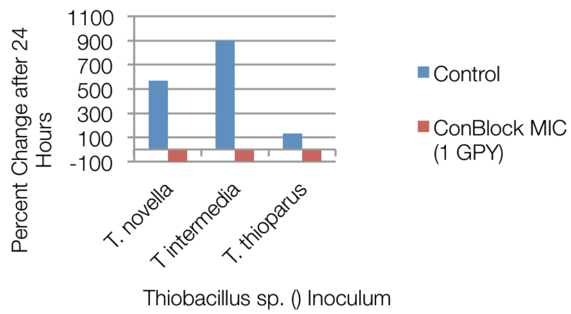
Microbial Induced Corrosion Defense for Concrete Sanitary Systems

Independent Laboratory Testing

ASTM D4783 Adapted for determination of antibacterial resistance of concrete to thiobacillus sp.
Reduction of Bacteria growth in 24 hours, pH ~9.0:

Thiobacillus novella	99.9%
Thiobacillus intermedia	99.9%
Thiobacillus thioparus	99.9%

ISO 22196 Modified Method for Concrete, pH ~6.8



Limited Warranty

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ISO 9001 Registered

ConBlock MIC Testing Summary

The previously recognized test method for antimicrobial efficacy of concrete - ASTM D4783-01[1] – begins with reducing the pH of the concrete surface to approximately 9.0 through an accelerated aging process. The scientist then inoculates the specimens with bacteria found at the beginning stages of microbial induced corrosion. These three species of Thiobacillus bacteria are: T. novella, T. intermedia, and T. thioparus. The bacteria remain for 24 hours and are then collected and measured. Although the test confirmed that ConBlock MIC, dosed at one gallon per cubic yard of concrete, is effective in controlling 99.99% of these harmful bacteria (*see page 4.3*). The test also indicated that at a surface pH of 9.0 the concrete would naturally cause the reduction of some of the bacteria. Therefore, a second study was conducted, similar to the first, which sought to find the pH level that these bacteria successfully survive, colonize, and continue the destructive chain of events to corrode the concrete.

This second study – ISO 22196[2] - continues the accelerated aging process of the concrete surface to a pH range of 6.5 to 6.8. In this pH range the bacteria, when inoculated for the 24-hour test, colonize and grow on the concrete surface. Upon confirmation of bacteria growth on untreated specimens, the remaining specimens are inoculated. This new test standard was conducted on the following test samples:

- Sample #1: T0 Control, Normal concrete (0.42 WCR)
- Sample #2: Normal concrete with a topical dilution of ConBlock MIC mixed 4:1 with water
- Sample #3: Concrete with ConBlock MIC at the dosage rate of one gallon per yard
- Sample #4: Concrete with ConBlock MIC at the dosage rate of four gallons per yard
- Sample #5: Sample #2 with our red dye test indicator applied
- Sample #6: Normal concrete with a topical dilute of ConBlock MIC (4:1) with a dye

The results (*see page 4.6*) support the prescribed solution for treating concrete to control the bacteria leading to microbial induced corrosion – one gallon of ConBlock MIC per cubic yard of concrete. This dosage rate is very effective at controlling the colonization and growth of these bacteria. Additionally, the application of a topical treatment of ConBlock MIC on control specimens is effective. The dramatic difference between the two tests is the bacteria survival and reproduction on control specimens in the second study (*results on page 4.5*).

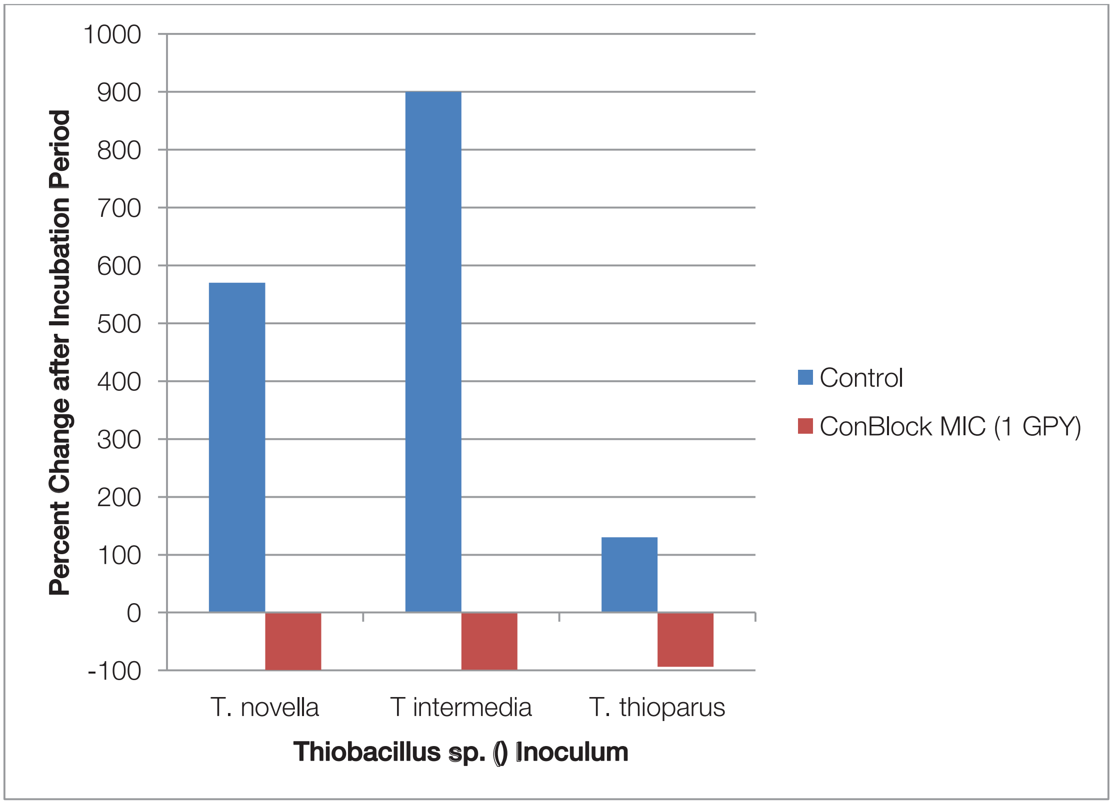
[1]: ASTM D4783-01 Adapted for determination of antimicrobial resistance of concrete
[2]: ISO 22196 Modified for Concrete

ConBlock MIC Effectiveness Study

Testing confirms that ConBlock MIC, when mixed into concrete at the rate of one gallon per yard (GPY), is effective at controlling bacteria that leads to microbial induced corrosion of concrete structures. Testing validates, when concrete has aged to a point that bacteria can survive, specimens treated with ConBlock MIC have significant reduction in the bacteria count while untreated specimens show bacteria reproduction. This test validates the effectiveness of ConBlock MIC in controlling the bacteria, breaking the chain of microbial induced corrosion.

Test Data from 12/20/11

Thiobacillus sp. ()	Untreated Control	ConBlock MIC Treated
T. novella	+570%	-99.4%
T. intermedia	+900%	-98.5%
T. thioparus	+130%	-93.5%



Testing was performed on concrete aged to a pH of 6.5-6.8. The test method is ISO 22196 Modified Method for Concrete.

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Customer Report

Monday, February 14, 2011

Contact	Concrete Sealants Inc	Sam Lines	937-845-8776
Title	Modified Methods- Microbial growth inhibition analysis for aged standard and treated concrete.		
Project ID	0810-ACP-01 -- 2	Entry Date 12/14/2010	Test Start Date 1/3/2011

Sample Result Table

Sample # 1 — **0.25% Bulk treated - w Acc Aging**

Test Method: ASTM D4783 - 01(2008) Adapted for determination of antibacterial resistance of concrete to thermobacillus sp.

Inoculum	Interval	Result
Mixed Thiobacillus sp. ()		
T. novella - 99.999% reduction	**24** *hr*	**5.1** *Log10 Reduction*
T. intermedia - 99.997% reduction	**24** *hr*	**4.6** *Log10 Reduction*
T. thioparus - 99.988% reduction	**24** *hr*	**3.9** *Log10 Reduction*

Sample # 2 — **2% coating - w Acc. Aging**

Test Method: ASTM D4783 - 01(2008) Adapted for determination of antibacterial resistance of concrete to thermobacillus sp.

Inoculum	Interval	Result
Mixed Thiobacillus sp. ()		
T. novella - 99.989% reduction	**24** *hr*	**4** *Log10 Reduction*
T. intermedia - 99.982% reduction	**24** *hr*	**3.7** *Log10 Reduction*
T. thioparus - 99.9%	**24** *hr*	**3** *Log10 Reduction*

d p satchell

Don P. Satchell Ph.D., Director

SiTU Biosciences LLC

Microbial Test Experts[SM]

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Customer Report

Thursday, March 01, 2012

Contact

Concrete Sealants Inc
9325 St. RTE 201

Tipp City OH 45371-8524

Sam Lines
1-800-332-7325
slines@conseal.com

Project Title

ISO 22196 Modified for Concrete Test

ID **1211-ACP-01 -- 1** Entry Date 12/20/2011

Project Summary

Overview: Concrete samples were tested for *Thiobacillus* sp. antibacterial performance using a modified ISO 22196 quantitative test method.

As no current official method exists for testing of antibacterial properties of concrete material, a modified ISO 22196 test method was adapted to determine the percent recoverable bacteria from treated and untreated concrete samples. Samples were first exposed to two cycles of a pH controlled misting for 21 days and then 15 days to obtain a pH near 6.8. A preliminary test was performed to determine that untreated control concrete would not significantly kill bacteria inoculated onto the samples within the test time period.

Test sample neutrality was confirmed and samples were removed from the mist chamber and rinsed with sterile deionized water prior to testing. Once prepared, the samples were inoculated with a mixed Thiobacillus inoculum of *T. novella*, *T. intermedia* and *T. thioparus*. The inoculated samples were incubated for 24 hours and then samples were removed and neutralized prior to plating. The pH determined for the test samples was ~6.8 prior to inoculation of the test organisms, and following the incubation period.

Test sample results for the 24 hour incubation time period are calculated according to the ISO 22196 method and indicate the bacterial reduction relative to the untreated control samples at the 24 hour time point. Untreated control samples demonstrated no significant bacterial reduction within the test timeframe.

Sample List

Method Name

Accelerated Aging - water mist with rain/fog balanced mineral content and pH

Sample #	*Sample Name*	*Sample Notes*
1	1213113 - T0 Control	S6 mist proceedure
2	1202112	S6 mist proceedure
3	1203113	S6 mist proceedure

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Customer Report

Thursday, March 01, 2012

Contact	Concrete Sealants Inc	Sam Lines	1-800-332-7325
Title	ISO 22196 Modified for Concrete Test		
Project ID	1211-ACP-01 -- 1	Entry Date 12/20/2011	Test Start Date 12/20/2011

Sample Result Table *

Sample # 1 — **1213113 - T0 Control**

Test Method: Accelerated Aging - water mist with rain/fog balanced mineral content and pH

Inoculum *None ()*

	Interval	Result
completed; aproximate pH following aging = 6.5 to 6.8	**36** *day*	*None*
completed; aproximate pH following aging = 6.5 to 6.8	**36** *day*	*None*

Test Method: Adapted method ISO 22196 for determination of antibacterial resistance of concrete to Thiobacillus sp.

Inoculum *Thiobacillus sp. ()*

	Interval	Result
T. novella; 1.11E5 CFU/sq cm	**0** *hr*	**0** *Log10 Reduction*
T. intermedia; 4.13E4 CFU/ml	**0** *hr*	**0** *Log10 Reduction*
T. thioparus; 4.32E5 CFU/ml	**0** *hr*	**0** *Log10 Reduction*
T. novella; 6.32E5 CFU/sq cm	**24** *hr*	**0** *Log10 Reduction*
T. intermedia; 3.73E5 CFU/ml	**24** *hr*	**0** *Log10 Reduction*
T. thioparus; 5.77E5 CFU/ml	**24** *hr*	**0** *Log10 Reduction*

Sample Result Table *

Sample # 2 1202112

Test Method	Accelerated Aging - water mist with rain/fog balanced mineral content and pH	
	Interval	**Result**
Inoculum *None ()*		
completed; aproximate pH following aging = 6.5 to 6.8	**36** *day*	*None*

Test Method	Adapted method ISO 22196 for determination of antibacterial resistance of concrete to Thiobacillus sp.	
	Interval	**Result**
Inoculum *Thiobacillus sp. ()*		
T. novella; Percent Reduction = 84.0%	**24** *hr*	**0.93** *Log10 Reduction*
T. intermedia; Percent Reduction = 95.1%	**24** *hr*	**1.38** *Log10 Reduction*
T. thioparus; Percent Reduction = 88.3%	**24** *hr*	**1.1** *Log10 Reduction*

Sample # 3 1203113

Test Method	Accelerated Aging - water mist with rain/fog balanced mineral content and pH	
	Interval	**Result**
Inoculum *None ()*		
completed; aproximate pH following aging = 6.5 to 6.8	**36** *day*	*None*

Test Method	Adapted method ISO 22196 for determination of antibacterial resistance of concrete to Thiobacillus sp.	
	Interval	**Result**
Inoculum *Thiobacillus sp. ()*		
T. novella; Percent Reduction =99.4%	**24** *hr*	**2.23** *Log10 Reduction*
T. intermedia; Percent Reduction = 98.5%	**24** *hr*	**1.82** *Log10 Reduction*
T. thioparus; Percent Reduction = 93.5%	**24** *hr*	**1.36** *Log10 Reduction*

Sample Result Table *

Test Method - Additional Information

ISO 22196 Modified Method for Concrete
This test method is adopted from the ISO 22196 method for testing antimicrobial performance of plastic, polymeric materials, and antimicrobial performance of treated materials. The procedures in this modified method are significantly similar to the official ISO methods, but they do not purport to represent the ISO standard.

Modifications relative to the ISO 22196 standard:

- Required aging period of the test samples prior to testing
- Use of *Thiobacillus* bacterial species, incubation temperatures are conducted at 29C +/-1C
- Incubation temperature to accommodate Thiobacillus sp.
- Procedures in preparation of test samples following aging

ISO 22196:2007 specifies a method of evaluating the antibacterial activity of antibacterial-treated plastic products (including intermediate products). It is not intended to be used to evaluate the effects and propagation of bacteria on plastics without antibacterial treatments.

Antimicrobial activity is determined in the following manner:

***R* = (*U*t -U0) - (At-U0) = Ut - At**
where
R is the antibacterial activity;
***U*0** is the average of the common logarithm of the number of viable bacteria, in cells/cm2, recovered from the untreated test specimens immediately after inoculation;
***U*t** is the average of the common logarithm of the number of viable bacteria, in cells/cm2, recovered from the untreated test specimens after 24 h;
***A*t** is the average of the common logarithm of the number of viable bacteria, in cells/cm2, recovered from the treated test specimens after 24 h.

For purposes of common reference, the % reduction is also reported in the notes section for each sample result.

Notation of changes to the published test method:
- Several references are made to 'Plate count agar' for the test method plating following neutralization and recovery of the bacterial from the test samples. As standard practice, counts are performed on appropriate plate media such as Nutrient agar, tryptic soy agar, or as required by the specific organism tested.
- The published standard refers to incubation conditions of 35 C +/- 1C. Standard microbiological practice with other international methods is for incubations to occur at 37 C +/- 1C. The test conditions performed will be conducted at 37 C +/- 1C unless specified for other temperature conditions.

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Standard Specification for ConBlock MIC

In Concrete and Cementitious Materials

General Specifications

The intent of the antimicrobial additive, ConBlock MIC, is to render the concrete uninhabitable for microbial growth. In addition to Project Specifications, the following are general specifications for the use of antimicrobial additives in new concrete infrastructure and cementitious infrastructure repair products:

a) The liquid antimicrobial additive shall be an EPA registered material.
b) Required submittals for approval prior to use on the project:
   - US EPA Product Registration Number.
   - State pesticide registration documentation, where required by law.
c) Submit from the producer Good Manufacturing Practice Plan and Quality Assurance Plan documentation.
d) The amount of additive and the proper mixing procedures used shall be as recommended by the manufacturer of the antimicrobial additive. The additive shall be added into the concrete mix water to ensure even distribution of the additive throughout the concrete mixture.
e) The antimicrobial additive shall have successfully demonstrated prevention of microbiological growth on concrete based on ISO 22196 Modified Method for Concrete to determine the antimicrobial resistance of concrete to Thiobacillus sp. The concrete shall be conditioned before testing to have a surface pH of no higher than 6.8.
f) The mix design used shall be reviewed by the manufacturer of the antimicrobial additive to check compatibility with all other admixtures, chemicals and minerals.

ConBlock MIC EPA Registration Number: 64881-7-87907
Contact Concrete Sealants, Inc. for state pesticide registration documentation.

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Standard Specification for ConBlock MIC

In Concrete and Cementitious Materials

Specifications Specific to Application

The "General Specifications" shall be adopted for all concrete and cementitious material applications for antimicrobial additives. Additional specifications may be necessary in certain applications.

Precast Concrete Pipe, Manholes, and Septic Tanks

The "General Specifications" shall be added to product requirements when concrete is needed to resist the corrosion from microbes: ASTM C76 Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; ASTM C 478 Standard Specification for Precast Reinforced Concrete Manhole Sections; and ASTM C1227 Standard Specification for Precast Concrete Septic Tanks.

In addition to the "General Specifications", the following specifications shall also be added to product requirements specifically for products of this category:

a) Where concrete corrosion is already known, or likely to occur, the additional protection of a topical solution of one part **ConBlock MIC** to 4 parts clean water shall be applied topically to the steps, PVC pipes, lids, and risers to eliminate the potential for bacteria to grow on any surface.

b) Field repairs to the precast concrete shall be made using a non-shrink repair mortar treated with **ConBlock MIC** at a dosage rate of 6 fl oz/50 lbs (148 mL/22.7 kg) of mortar. This repair mortar shall be used for filling joints, lift holes, damaged areas, benches, and similar areas of the precast structure.

Ready-Mix Concrete

In addition to the "General Specifications", the following specifications shall also be required for ready-mix concrete when concrete is needed to resist the corrosion from microbes:

a) Where concrete corrosion is already known, or likely to occur, the additional protection of a topical solution of one part **ConBlock MIC** to 4 parts clean water shall be applied topically to all surfaces within a sewer system to eliminate the potential for bacteria to grow on any surface.

b) Field repairs to the ready-mix concrete shall be made using a non-shrink repair mortar treated with **ConBlock MIC** at a dosage rate of 6 fl oz/50 lbs (148 mL/22.7 kg) of mortar. This repair mortar shall be used for filling joints, lift holes, damaged areas, benches, and similar areas of the concrete structure.

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Standard Specification for ConBlock MIC

In Concrete and Cementitious Materials

Shotcrete Rehabilitation and Field Repairs of Pipe, Manholes and Similar Sewer Structures

In addition to the "General Specifications", the following specifications shall also be required for shotcrete repair mortars when it is needed to resist the corrosion from microbes:

a) The dosage rate for shotcrete and non-shrink repair mortar treated with **ConBlock MIC** is 6 fl oz/50 lbs (148 mL/22.7 kg) of mix. This amount shall be included in the total water content used with the shotcrete or repair mortar.

b) Repair mortar shall be used for filling joints, lift holes, damaged areas, benches, and similar areas of the concrete structure.

c) For both wet and dry shotcrete, the additive shall be blended with the shotcrete mix water to ensure even distribution of the additive throughout the shotcrete.

d) Where concrete corrosion is already known to occur, the additional protection of a topical solution of one part **ConBlock MIC** to 4 parts clean water shall be applied topically to all surfaces within a sewer system to eliminate the potential for bacteria to grow on <u>any</u> surface.

e) OPTIONAL: **ConBlock MIC** shall be diluted 4:1 with potable water and be spray applied to the cleaned and prepared interior surface prior to applying shotcrete to prepare and protect the underlying substrate.

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Standard Specification for ConBlock MIC

In Concrete and Cementitious Materials

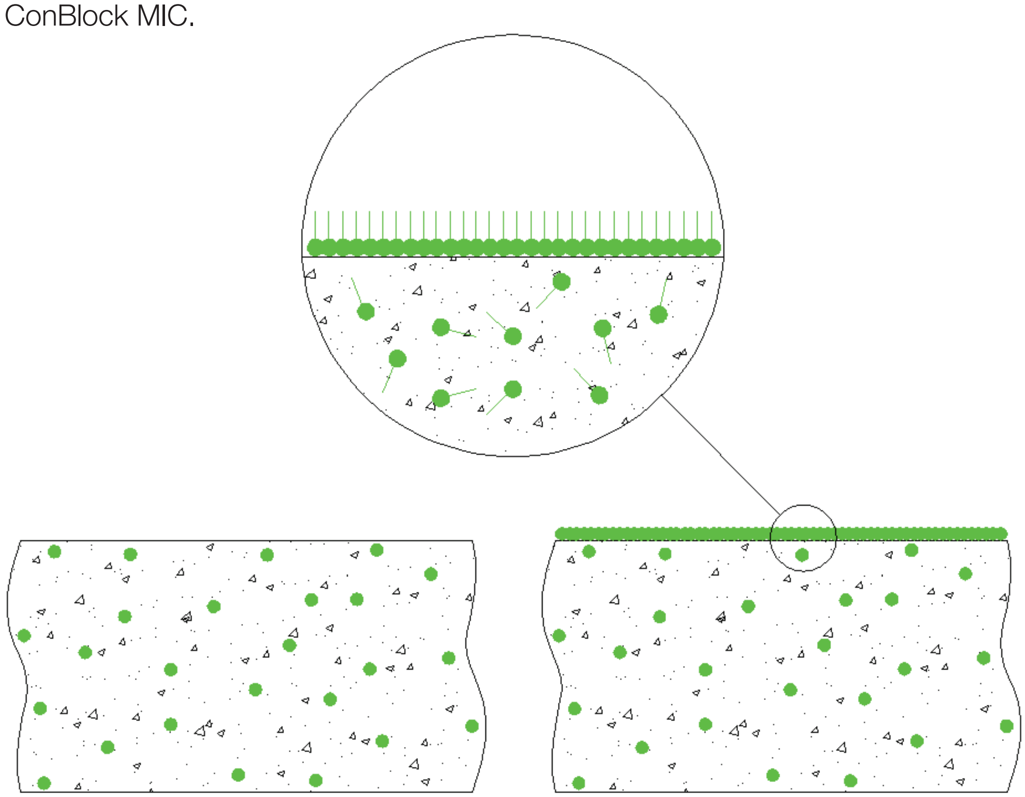
Procedures

The following recommendations are based upon laboratory testing of ConBlock MIC using an adaptation of test method ISO 22196 for Determination of Antibacterial Resistance of Concrete to Thiobacillus Species.

- **Basic Protection:** One gallon of **ConBlock MIC** per cubic yard (5 L/M^3) of concrete as a replacement for an equal amount of mixing water.

- **Additional Protection**: In addition to the Basic Protection, it is also recommended that a topical solution of one part **ConBlock MIC** to 4 parts clean water be applied topically to the steps, PVC pipes, lids, and risers to control the potential for bacteria to grow on any surface.

ConBlock MIC must be accurately dosed. Compatibility of all mix additives is critical to the successful performance of ConBlock MIC.



One (1) Gallon per Cubic Yard (5 L/M^3)

One (1) Gallon per Cubic Yard (5 L/M^3) plus Topical

Disclaimer: This publication is to assist users to understand the proper use of ConSeal's products. *Contact ConSeal's technical staff for practices and procedures that meet your specific requirement.* Concrete Sealants, Inc. does not warranty any improper use of its products.

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Quality Assurance Plan

ConBlock MIC

General Recommendations

a) The mix design including ConBlock MIC shall be documented.
   i. The materials used in the quantities per cubic yard (or cubic meter) of concrete shall be listed on the mix design record.
   ii. The mix design record shall indicate the batch sequence for each material including mixing times.
   iii. The lot number of the ConBlock MIC used shall be recorded.
   iv. Batch records shall be retained for seven years.

b) Concrete Sealants, Inc. shall review the mix design record and the batching sequence prior to making the first batch of concrete.

   Note: This validation will assure that the materials and processes used by the producer will not impede the efficacy of the ConBlock MIC admixture (reference ConBlock MIC Compatible Additives List).

c) The producer will complete a Certificate of Conformance to document that the batching process and required specifications for ConBlock MIC treatment were correctly followed.

d) A Water Quality Analysis shall be provided with the Certificate of Conformance.

e) If the producer chooses not to follow any of the steps (a) through (d) above, the producer shall add ConBlock MIC at the end of the batch cycle and mix for a minimum of five (5) minutes after addition. This shall be noted on the Certificate of Conformance.

Optional, Additional Recommendations

Option 1: Integral Colorant: a colorant that shall be used integrally to tint the concrete. This colorant shall be added when used with ConBlock MIC to indicate treatment. The dye for integral application is available from Concrete Sealants, Inc.

Option 2: Direct Stain Test: The Direct Stain Test, developed by Concrete Sealants, shall be used to indicate the presence of ConBlock MIC at the surface of the concrete. See Direct Stain Test document for test method details. ConSeal's Direct Stain Test is designated for in-factory use with test sample retains. Contact Concrete Sealants, Inc. for the ConSeal's Direct Stain Test Kit.

Option 3: Bacteria Inoculation Testing: An antimicrobial efficacy test shall be conducted with the materials in the same volumes that are used in the mix design including ConBlock MIC.

Note: The time-period of this testing should be considered before making it a requirement as testing too frequently may become impractical. See Bacteria Inoculation Testing for details.

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CERTIFICATE OF CONFORMANCE
for ConBlock MIC

To be effective in controlling the growth and colonization of acid producing bacteria on concrete and cementitious materials, the producer listed below affirms that the processes prescribed by Concrete Sealants, Inc. for integrating ConBlock MIC into their mix were followed. This document serves as evidence of quality conformance from the producer to the purchaser.

It is the responsibility of the purchaser to confirm that the producer, as documented on this Certificate of Conformance, has followed all of the required specifications.

The producer of the concrete or cementitious product(s) with ConBlock MIC integrated is:

____

The project name for the concrete or cementitious product(s) containing ConBlock MIC is:

____

The producer certifies that the following **General Recommendations** were followed:

- ☐ The admixture(s) used in this mix have been verified with Concrete Sealants, Inc. and were considered compatible with ConBlock MIC.
  - If applicable, the admixture(s) is(are): _______________________________________

- ☐ ConBlock MIC was added using either one of these methods:
  a) ConBlock MIC was added into the mix water at the **minimum** dosage rate of one gallon per cubic yard of concrete (5 L/M^3)/ **minimum** 6 fl oz/50 lbs (148 mL/22.7 kg) dosage of ConBlock MIC in cementitious mortar
  OR
  b) ConBlock MIC was the last material added and the mix time is a minimum of five (5) minutes after addition.

- ☐ Water Quality Analysis is completed in accordance with the Concrete Sealants, Inc. Quality Assurance Plan for ConBlock MIC. Attached.

Optional, Additional Requirements on back.

Quality Inspectors Initials: ________________________ Date: ________________

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The following **Additional Recommendations** are **Optional**. Where the purchaser does not require the element, place the mark “N/A” next to the item.

- ☐ Application of surface protection with a topical solution of ConBlock MIC, diluted 1-part ConBlock MIC with 4-parts clean water. Treatment was applied to the following (circle all that apply):

Concrete Surface **Attachments** **Hardware** **Lids** **Risers**

- ☐ Colorant added with the dosage rate and procedures recommended by Concrete Sealants, Inc.
  - Dosage rate used: ______________________________________
    - Circle Colorant Application (circle both if applicable):

Integral **Topical**

- ☐ Retention of two test samples for **Direct Stain Testing**, in accordance to the ConBlock MIC Quality Assurance Test Sample Retain document.

- ☐ Retention of two test samples for **Bacteria Inoculation Testing**, in accordance to the ConBlock MIC Quality Assurance Test Sample Retain document.

______________________________________ ____________________

Signature of Quality Inspector **Date**

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WATER QUALITY ANALYSIS
for ConBlock MIC

The concrete mix water to be used with ConBlock MIC shall be tested for compatibility prior to use. The measurements below are to be recorded and sent to Concrete Sealants, Inc. for approval from their quality inspector. Upon completion, this document is to be provided with the Certificate of Conformance in accordance to the Quality Assurance Plan for ConBlock MIC.

The Water Quality Test should be conducted once every month when ConBlock MIC is used on a monthly basis. If a producer has not used ConBlock MIC for more than forty-five (45) days, a Water Quality Test should be run within seven (7) days prior to the next use of ConBlock MIC.

As a general rule, it is not necessary to use distilled water for mixing application strength solution. Room temperature or slightly warm tap water is preferred. Ideally, the mixing water should have a pH range of 5.5 to 8.0. The use of potable water is acceptable in lieu of pH testing.

Concrete Mix Water is potable: _______ **or pH measurement:** ______
Inspector's Initials: ______________

Water that has a hardness level greater than 600-ppm may cause the active ingredient in ConBlock MIC to form flakes and come out of solution. If water hardness exceeds the 600-ppm level, compatibility testing by Concrete Sealants, Inc. is required.

Concrete Mix Water ppm: _______________ Date: ________________
If over 600-ppm, compatibility test results:
(ConSeal Inspector will circle result, or mark "NA" if Not Applicable)

Compatible Incompatible

Inspector's Initials: _______________ **ConSeal Inspector's Initials**: _______________

Producer Quality Inspector's Signature:

____ Date: __________________

Concrete Sealants, Inc. Quality Inspector's Signature:

____ Date: __________________