BIO-SAN® C500

PRECAST & CAST-IN-PLACE CONCRETE

Protection Against Microbial Induced Corrosion
and Chemical Attack – Provision of Waterproofing

Description

Xypex Bio-San C500 is a uniquely designed admixture for integral, long-term protection of concrete in sewage conditions with levels of H_2S that cause microbial-induced corrosion. Bio-San Admix combines potent antimicrobial protection along with the unique crystalline technology of the Xypex C-Series. Bio-San Admix contains bioactive mineral solids that become permanently fixed within the cement matrix impairing biofilm formation thus inhibiting the growth of acid causing sewer bacteria such as Thiobacillus due to a buildup of H_2S. The unique Xypex Crystalline Technology creates a permanent structure throughout the pores and capillary tracts, providing waterproofing and enhanced chemical protection. Bio-San Admix inhibits microbial induced corrosion (MIC), stops infiltration/exfiltration of water, and reduces acid and sulphate attack, significantly extending the service life of concrete sewage collection systems and wastewater infrastructure. Bio-San Admix normally contains a brown pigment for identification purposes but it may be ordered in gray.

Recommended for:

- Manholes / Sewer Pipes
- Pump and Lift Stations
- Head Works
- Septic Tanks
- Digesters
- Clarifiers
- Industrial Structures

Advantages

- Inhibits microbial-induced corrosion
- Resists extreme hydrostatic pressure
- Resistant to aggressive chemicals (acids and sulphates)
- Can seal static hairline cracks up to 0.5 mm
- Becomes a permanent, integral part of the substrate and cannot be punctured, damaged or lose adhesion
- Does not contain any VOCs
- Less costly to apply than most other methods
- Added to the concrete at the time of batching and therefore not subject to weather and surface moisture constraints
- Contains brown pigment for identification in concrete

For assistance with project requirements, please contact the Xypex Technical Services Department.

Dosage Rates

Xypex Bio-San C500:

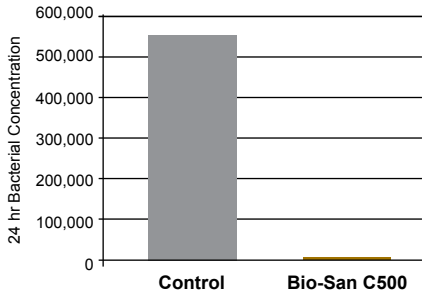
1% by weight of total cementitious content.

Test Data

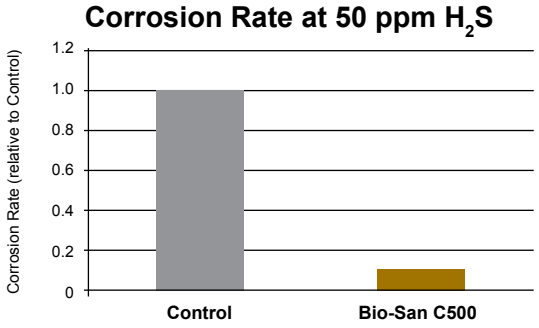
ANTIMICROBIAL EFFECT & CORROSION RATE

ISO 22196 (Modified) "Evaluation of Antimicrobial Effect of Xypex Bio-San C500 and Corrosion Rate", McGrath Engineering Ltd, North Vancouver, B.C., Canada

Xypex Bio-San C500 was added at 1% dosage rate to Portland cement mortar and compared to untreated control samples for antimicrobial performance. A substantial reduction in the sewer bacteria *Thiobacillus novellus / Starkeya novella* was found indicating a definite antimicrobial effect.



Concrete was cast in 100 x 200 mm cylinders with both control and treated mixes. A wastewater facility was chosen that had elevated H_2S levels and substantial existing MIC corrosion damage. Test samples were suspended in the air space of the tank for 10 years. Exposure trials showed that treated concrete had nine times less concrete mass loss compared to control samples.



PERMEABILITY

U.S. Army Corps of Engineers CRD C48, "Permeability of Concrete", Aviles Engineering Corp., Houston, USA

Two concrete samples containing Xypex Admix and an untreated control sample were tested for water permeability. Both the treated and untreated samples were subjected to a pressure of 150 psi / 1.04 MPa (350 ft. / 106.7 m water head). Results showed moisture and permeated water throughout the untreated sample after 24 hours. However, the Xypex Admix samples showed no leakage and water penetration of only 1.5 mm / 0.06 inches after 120 hours (5 days).

ACCI Water Permeability Test, "Water Permeability of Concrete", Australia Centre of Construction and Innovation, University of New South Wales, Sydney, Australia

Concrete samples containing Xypex Admix at a dosage rate of 0.8% and 1.2% were tested for water permeability against control samples. All the samples were subjected to a pressure of 10 bars (100 meters / 328 ft. water head) for 2 weeks. Water permeability coefficients were calculated and the Xypex Admix-treated concrete showed a significant reduction in water permeability by up to 93% at a dosage rate of 1.2%.

STN EN 12390-8 "Testing of Hardened Concrete; Depth of Water Penetration Under Pressure", Technical and Testing Construction Institute, Bratislava, Slovakia

Concrete cubes were prepared with Xypex Admix at 1%, along with control cubes. A water pressure of 0.5 MPa was applied for 72 hrs. and specimens were subsequently split transversely to measure the depth of water penetration. Depth results for Xypex Admix were between 10.3 mm and 25 mm, whereas penetration on control samples was 113 mm. Using the Valenta equation to calculate the water permeability coefficient, the Xypex Admix treated concrete showed a 20 to 120x reduction compared to the control concrete.

COMPRESSIVE STRENGTH

AS 1012.9-2014, "Methods of Testing Concrete – Compressive Strength Tests", University of Queensland, Australia

At 28 days the compressive strength of concrete containing Xypex Bio-San C500 was 56.4 MPa (8,200 psi) as compared to the control concrete of 47.5 MPa (6,900 psi). Testing indicates a positive impact on strength.

CHEMICAL RESISTANCE

CSN 73 1326 "Measuring Loss of Surface Due to Sulphate Attack of Concrete Treated with Xypex Admix", Betonconsult, Building Materials Testing Laboratory, Prague, Czech Republic

Concrete specimens treated with Xypex Admix at 0.5% and 1% were cast along with non-treated concrete specimens. The specimens were exposed to a highly concentrated sulfate solution (i.e. 36,000 mg/ℓ) for 4 months and samples were periodically weighed to determine mass loss. The Admix treated samples recorded a mass loss between 5 and 50 g/m^2 and showed no surface deterioration, while the non-treated specimens measured an average mass loss of 4,860 g/m^2 with significant surface deterioration.

"Sulfuric Acid Resistance Test", Aviles Engineering Corporation, Houston, USA

Concrete samples containing Xypex Admix at different dosage rates including 3% specimens were tested against untreated control samples for sulfuric acid resistance. After immersion in the sulfuric acid, each sample was tested for weight loss on a daily basis until a weight loss of 50% or a definite response trend was obtained. The percentage weight loss of the samples containing Xypex Admix tested significantly lower than the control samples.

CRACK SEALING

"Testing of Xypex Admix Crack Healing Capabilities" CH Karnchang (Lao) Company Ltd., Xayaburi Laboratory, Ban Xieng Yeun, Vientiane, Laos

Prior to the construction of a Mekong River dam, testing was undertaken to substantiate the ability of Xypex Admix to self-heal static cracks. Three large concrete slabs treated with Xype Admix at 0.8% were cast along with three control slabs. Following curing, a force was applied at the mid-point of each slab to create cracks with widths from 0.2 to 0.5 mm on the surface. Water was ponded above the cracked area. Initially all cracks leaked; at 4 days, all dripping had ceased from the cracks of the Xypex treated panels, while leaking continued through the cracks of the control slab until the end of the test period (25 days). SEM photographs showed significant crystalline growth throughout the cracks of the Admix-treated slab.

SCANNING ELECTRON MICROSCOPY

SEM "Microscopic Examination of Crystalline Products in Three Xypex Admix Modified Mortars", Australian Centre for Construction Innovation, University of New South Wales, Sydney, Australia



Slag and fly ash blended cement samples were treated with Xypex Admix and examined for evidence of crystalline growth at ages ranging from 8 months to 2 years. Samples were sliced and/or split and examined at magnifications between 500x and 5000x. Characteristic Xypex crystalline growth was observable on all Xypex treated samples, providing evidence of Xypex crystalline reactions with fly ash and slag blended cements.

FREEZE/THAW DURABILITY

ASTM C 666, "Freeze/Thaw Durability", Independent Laboratory, Cleveland, USA

After 300 freeze/thaw cycles, the Xypex Admix-treated samples indicated 94% relative durability.

Packaging

Xypex Bio-San Admix is packaged in 50 lb. (22.7 kg) pails. Contact the manufacturer for availability of custom-sized packaging to meet the requirements of your specific project. Soluble bags are available.

Storage

Xypex products must be stored dry at a minimum temperature of 7ºC. Shelf life is two years when stored under proper conditions.

Directions for Use

Xypex Bio-San Admix is added to the concrete at the time of batching. It is important to obtain a homogeneous mixture of Xypex Bio-San Admix with the concrete. The sequence of procedures for addition will vary according to the type of batch plant operation and equipment. The following methods have been used successfully in the past, and it is recommended that the local Xypex Representative be consulted about the best method to use.

1. TRUCK ADDITION (AT PLANT) Add Xypex Bio-San Admix in bulk powder form to the drum of the ready-mix truck immediately prior to driving the truck under the batch plant and adding the balance of the materials in accordance with standard concrete batching practices. Avoid delays in adding other components and utilize high speed mixing to ensure homogeneity of the mix. Account for any added water in the mix design and slump.

2. ADDITION TO CENTRAL MIXER Load the Bio-San Admix in bulk powder form along with the other components. Mix as per standard batching practices to ensure thorough dispersal of the Bio-San powder resulting in a homogeneous mixture. Account for worker safety issues when accessing the equipment.

3. ADDITION TO COARSE AGGREGATE BELT Add Xypex Bio-San Admix powder directly to the coarse aggregate conveyor belt manually or through computer controlled mass batching system. Account for worker health and safety issues with moving belts and wind-blown dust issues.

NOTE:

i. For installations involving pan mixers, the recommended procedure would be to initially add some of the mix water and coarse aggregate to the pan mixer begin mixing and slowly add the Xypex Bio-San Admix powder. Mix until the Bio-San Admix powder is thoroughly dispersed and forms a slurry, then add the balance of the materials and continue to mix as per normal.

ii. Although addition on site in a powder form is not normally recommended, it may be necessary. Mix concrete on high speed until thoroughly dispersed. Do not add water directly to the admixture, as it may result in foaming.

iii. Concrete containing the Xypex Bio-San Admix does not preclude the requirement for design of crack control, construction joint detailing, proper placement, consolidation and curing of the concrete and measures for repairing defects such as honeycombing, tie holes, cracks beyond specified limits.

iv. Further guidelines are available that address the use of Xypex Bio-San Admix for a specific situation, (e.g. dry mixes, use of ice in hot ambient conditions, cold-weather concreting, etc.). Consult with a local Xypex Representative or Xypex's Technical Services Department for further information.

Setting Time and Strength

The setting time of concrete is affected by the chemical and physical composition of ingredients, temperature of the concrete and climatic conditions. Concrete containing the Bio-San Admix may develop higher ultimate strengths than plain concrete. Trial mixes should be carried out under project conditions to determine the setting time and strength of the concrete dosed with Bio-San Admix. Concrete should be a minimum of 28 days age prior to placement into service.

Limitations

When incorporating Xypex Bio-San Admix, the temperature of the concrete mix should be above 4ºC.

Technical Services

For more instructions, alternative installation methods, or information concerning the compatibility of the Xypex treatment with other products or technologies, contact the Technical Services Department of Xypex Chemical Corporation or your local Xypex Representative.

Safe Handling Information

Xypex is alkaline. As a cementitious powder or mixture, Xypex may cause significant skin and eye irritation. Directions for treating these problems are clearly detailed on all Xypex pails and packaging. The Manufacturer also maintains comprehensive and up-to-date Safety Data Sheets on all its products.

Each sheet contains health and safety information for the protection of workers and customers. Xypex Bio-San C500 is EPA-registered (No. 92393-2). The Manufacturer recommends you contact Xypex Chemical Corporation or your local Xypex Representative to obtain copies of safety data sheets prior to product storage or use.

Warranty

The Manufacturer warrants that the products manufactured by it shall be free from material defects and will be consistent with its normal high quality. Should any of the products be proven defective, the liability to the Manufacturer shall be limited to the replacement of the product ex factory. The Manufacturer makes no warranty as to merchantability or fitness for a particular purpose, and this warranty is in lieu of all other warranties expressed or implied. The user shall determine the suitability of the product for his intended use and assume all risks and liability in connection therewith.

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