

## Nufins MCI-2020

### Migratory Corrosion Inhibitor

#### Description

Nufins MCI-2020 is a surface applied, migrating corrosion inhibitor designed to penetrate through cementitious materials including concrete, mortar, and limestone. Nufins MCI-2020 migrates in both liquid and vapour phases through the pore structure, forming a protective, molecular layer on embedded reinforcement. Nufins MCI-2020 provides corrosion protection against carbonation, chlorides, and other contaminants and outperforms many other similar products in the market.

#### Advantages

- Protects against corrosion caused by carbonation, chlorides, and other aggressive contaminants
- Effectively reduces corrosion rates on metals with existing corrosion
- Water based and non-flammable
- Does not etch, stain, discolour, or otherwise harm glass, metals, or automotive paint
- Does not contain calcium nitrite
- Does not contain wax
- Does not require removal of sound concrete
- Allows vapour diffusion (not a vapour barrier)
- Easily applied by spray, brush, or roller
- Minimal curing time, traffic may resume minutes after application if necessary (dry to touch)
- Migrates independent of orientation (horizontal, vertical, overhead)
- Migrates up to 75mm in 30 days
- Proven performance in both lab and field testing

#### How it works

Nufins MCI-2020 is an organic corrosion inhibitor. It is considered ambiodic (mixed) inhibitors which means they protect both anodic and cathodic areas within a corrosion cell. MCI-2020 contains a synergistic blend of amino-alcohols and salts of carboxylic acids which form a protective layer on embedded reinforcement delaying the onset of corrosion as well as reducing existing corrosion rates.

#### Applications

- Preventative maintenance of existing reinforced, precast, pre-stressed, post-tensioned, or marine concrete structures
- Bridges, highways, and industrial floors exposed to aggressive environments (carbonation, de-icing salts, chemical and atmospheric attack)
- Multi-Storey Car Park
- Concrete piers, dams, offshore platforms, piles, pillars, pipes, utility poles, and cooling towers
- Concrete potable water structures
- As a component of Nufins High Performance Repair System (HPRS)

#### Coverage

Nufins MCI-2020 is applied in a single coat at 0.3l/m<sup>2</sup> to horizontal surfaces. It is applied in two coats at 0.6l/m<sup>2</sup> to vertical and overhead surfaces.



## Technical Data

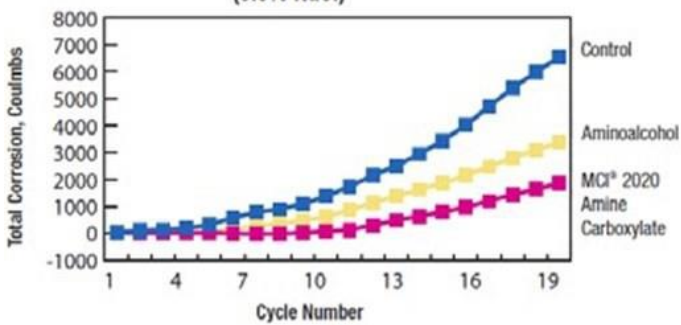
Table 1, Physical Properties

Type	Organic ambiodic corrosion inhibitors
Appearance	Clear to slightly hazy, amber liquid
pH	9.0-9.5 (neat)
Density	1.03-1.05 kg/litre
Water Vapour Transmission	1.72 perms
Shelf Life	24 Months, when unopened
Storage	0-60°C, protect from freezing

## Corrosion rate reduction - crack performance

### Cracked Beam Testing of Surface Treatments

#### Amine Based Products (3.5% NaCl)

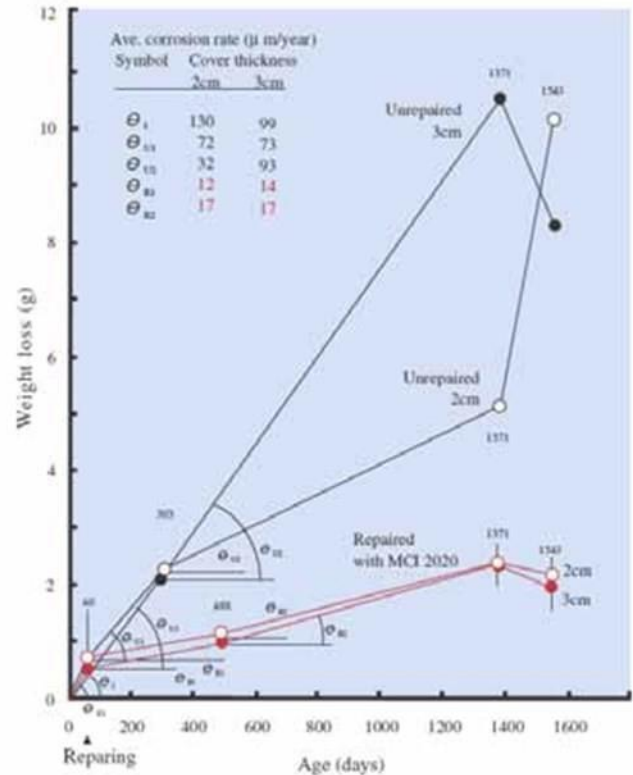


(adapted from ASTM G109)

Nufins MCI-2020 reduced corrosion current by 72% compared to the untreated sample, and also outperformed the amino-alcohol based surface treatment.

Sherman, Matthew R., Krauss, Paul D. Cracked-Beam Corrosion Tests of Concrete Treated with MCI-2020 Corrosion Inhibitor, Final Report, WJE No. 922041. January 1995.

## Corrosion rate reduction - pre-existing chlorides



Nufins MCI-2020 treated specimens decreased the amount of corrosion up by 1/2 to 1/6 that of the control samples. When applying MCI-2020 after cracks appeared, it worked very well in reducing corrosion rates in samples. Study used ASTM G109 sized beams cast with 3 rebar in a triangular array. Chloride solution was ponded on the surface for 2 weeks of a 4 week test cycle. Half-cell potentials and corrosion current readings were taken monthly.

Nagayama, Dr. Masaru; Shimozaawa, Mr. Kazuyuki. Long Term Corrosion Testing of MCI-2020 (November 1994-April 1999). General Building Research Corporation of Japan. April 1999.



### Limitations

**Penetration into concrete, film forming capability, chloride displacement.**

**Mass Concentration %**

Sample	Etch Time (seconds)	Fe 2p	O 1s	C 1s	N 1s	Cl 2p	Ca 2p	Si 2p
Untreated	0	6.27	42.71	30.67	0.19	1.07	14.19	4.97
Untreated	120	13.60	39.43	23.08	0.14	1.06	17.59	5.19
Untreated	240	14.65	38.77	22.35	0.11	1.01	18.18	5.03
L2020	0	2.30	42.22	29.90	1.16	0.95	17.28	6.26
L2020	120	2.53	43.01	25.17	1.12	0.93	20.14	7.18
L2020	240	2.56	43.85	21.95	1.05	1.40	22.19	7.09
L2020M	0	2.02	40.20	38.55	1.32	0.87	11.54	5.53
L2020M	120	2.22	41.74	32.13	1.29	0.86	15.41	6.42
L2020M	240	2.82	43.61	28.99	1.15	0.83	15.92	6.68

**Table 1 - XPS analysis on concrete samples after 500 days, showing the changes in chemistry with etch time.**

XPS analysis demonstrated the presence of inhibitor on steel rebar surfaces at levels 85 nm below the unetched surfaces (MCI-2020 M) and 75 nm (MCI-2020). The XPS results showed similar diffusion rates for the MCI and the corrosive species. The MCI-2020/ MCI-2020 M inhibitors were able to provide a protective film on the rebar surface, whereas the untreated samples were subjected to localized corrosion attack. From the XPS depth profiling, chloride was detected at depths of 60 nm from the analysis surface on the bar and at a concentration of roughly 0.44 weight percent for the untreated samples and 0.14% for treated samples, confirming displacement of the chloride ions. (NOTE: 10 nm = 100 Å)

Bavarian, Behzad, PhD. and Reiner, Lisa. The Efficacy of using Migrating Corrosion Inhibitors (MCI 2020) for Reinforced Concrete. California State University, Northridge, College of Engineering and Computer Science. March 2004.

## Surface Preparation

Surfaces should be dry, clean, and free of oil, grease, efflorescence, water repellents, coatings, membranes, and asphalt. Cleaning may be done by steam cleaning, water/sand blasting.

## Application

Apply Nufins MCI-2020 by spray (conventional airless or hand pressure spray equipment), brush or roller in accordance with coverage rates listed above. If applying more than one coat, allow the surface to dry enough between applications so that the second coat penetrates into the surface within 15 minutes. When applying a water repellent, coating, repair mortar, or overlay over MCI-2020 the surface should be rinsed with water, pressure washed, or blast-cleaned to remove any residue unless prior adhesion testing has been performed. Consult product specifications for more detailed application instructions.

## Considerations

- Substrate and ambient temperature should be above 2°C and below 50°C
- Do not apply if temperature is expected to fall below 0°C within 12 hours after application
- Nufins MCI-2020 will not penetrate water repellents, coatings, paints, membranes, or asphalt
- If structure will be submerged after application of Nufins MCI-2020, it is recommended to use a waterproofing coating over MCI-2020 prior to submersion
- Maximum chloride content at the depth of reinforcement in structures being treated with MCI-2020 is 3.5 kg/m<sup>3</sup>. For higher levels, consult Nufins technical department
- Do not apply if precipitation is expected within 8 hours after application

## Packaging

Nufins MCI-2020 is supplied in 20 and 210 litre drums.

## Storage

Nufins MCI-2020 should be stored at between 0 and 60°C, however it must be protected from frost, kept out of the reach of children and away from foodstuffs. All containers should be resealed after use.



## Health & Safety

Product Safety Data Sheets (SDS) are available from Nufins. SDS sheets are provided to help customers satisfy their safe handling, use and disposal needs as well as assist with any conformance requirements made locally by health and safety regulations.

SDS are continually updated to provide the very latest information to our customers. We therefore recommend contacting our head office to obtain the most recent and accurate SDS before handling and using any product.

## Technical Support

Through our technical department and laboratories we can offer a comprehensive service to specifiers and contractors. Technical contacts are available to provide further information and arrange demonstrations.

