Technical Bulletin 4
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Technical Bulletin

EIFS Council of Canada/ (416) 499-4000

Understanding Efflorescence

Individual Highlights:

We have all observed efflorescence, whether it is on the surface of masonry, concrete, stucco or exterior insulation finish systems (EIFS). One thing is common for all building materials and products that develop efflorescence; is it's unattractive appearance. To compound the problem, it typically occurs soon after construction when appearance is of greatest concern. For EIFS applications, not only is appearance a potential issue but also performance and durability. The intent of this bulletin is to discuss the causes of efflorescence and how to address it as it pertains to EIFS.

Efflorescence can influence EIFS at all stages of installation, from the substrate to the finish coat.

What is Efflorescence?

Efflorescence is a crystalline deposit, usually white and is a normal occurrence with building products that contain Portland cement, masonry cement and/or lime. It often gives an appearance of 'bleaching out', spotting, or other 'loss of colour' even though it is a deposit over the colour.

Mechanisms of Efflorescence Development?

Development of efflorescence occurs when water-soluble salts migrate to the exterior surface by vapour transmission where the water evaporates, leaving the salt deposit at the surface. The chemical composition may contain a varying mixture of carbonates, sulphides, sulphates, chlorides and other salts of calcium and sodium.

In most instances, salts that cause efflorescence come from building products and materials which contain cement. There are times when chemicals in the materials react with chemicals in the atmosphere to form efflorescence (also know as primary efflorescence). During hydration, the cement used with EIFS products releases various salts, principally calcium hydroxide (a soluble salt). When these salts are conveyed through capillaries to the surface, it combines with the carbon dioxide in the air to form calcium

Efflorescence on base coat

carbonate (insoluble). Primary efflorescence is immediate and is generally not recurring.

Unlike primary efflorescence, which typically creates uniform whitening at the surface, secondary efflorescence, may appear after initial application at random locations. Secondary efflorescence occurs when water penetrates the capillaries and extracts soluble salts (principally calcium hydroxide) to the surface. This is more of an issue with thicker cementitious products than with EIFS products because they have longer cement hydration periods (and resultant increased calcium hydroxide production). With additional calcium hydroxide brought to the surface, insoluble calcium carbonate may result.

Although the deposits of calcium carbonate from both primary and secondary efflorescence are insoluble in water, if left exposed they would be washed away by rainfall. This is because the calcium carbonate would react further with water and carbon dioxide to form soluble calcium bicarbonate.

When does Efflorescence Typically Occur?

"Efflorescence may act as a bond breaker and prevent adhesion of materials, finishes and coatings."

The development is more prevalent after damp, rainy periods in the winter, late fall or early spring when a slower rate of evaporation due to the lower temperatures and high relative humidity allow migration of the salts to the surface. Since calcium hydroxide is more soluble in water at cold temperatures than at warm temperatures, such deposits are again more common in winter than summer. Shaded elevations are also more likely to develop efflorescence.

In the summer, even after long periods of rain, moisture evaporates so quickly that fewer salts are brought to the surface because the salts have minimal time to dissolve. Unfortunately, this rapid evaporation effects curing and may result in a more porous cementitious product. If the wall is wetted from rain or other external sources, the porous base coat absorbs more water and could then lead to efflorescence.

Problems Associated with Efflorescence

Efflorescence may act as a bond breaker and prevent the adhesion of materials, finishes and coatings that are subsequently applied and may result in delamination or debonding, therefore applicators should avoid the following:

- Applying air/moisture barriers and adhering insulation to substrates, i.e. masonry or concrete with efflorescence.
- Adhering insulation to a cementitious air/moisture barrier with efflorescence.
- Applying additional lifts of base coat to base coat with efflorescence.
- Avoid applying finish coats over base coats with efflorescence.

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Efflorescence can leach through the finish coat and result in whitish staining on the surface. This is more noticeable with darker colours.

Key Causes of Efflorescence

In addition to the use of cementitious materials, several factors may influence or increase the severity of efflorescence including:

- Contact with soil containing soluble salt compounds that can be carried by capillary action within EIFS materials.
- Saltwater used for mixing.
- Hairline cracks in the lamina that increases the absorption of water in the vicinity of the crack.
- Poor water shedding details that increase absorption of water.
- Poor curing/drying conditions and external water sources (dew, fog, rain, sprinklers).
- Applying the finish coat too thinly to protect base coat (typically occurs during spray application).
- Avoid applying paint or other coatings over top of a finish coat with efflorescence.

Efflorescence on base coat

- Free water behind base coat originating from leaks.
- Brushing or smoothing base coat with brush.
- Adding too much mix water to base coat.
- Salts and lime in adjacent masonry or concrete.

Assessing the Extent of Efflorescence

Prior to Finish Application

- It is important not to confuse efflorescence with cementitious products that have cured/dried under varying environmental conditions, which tend to give certain areas a grey to whitish colour in comparison to the remainder of the wall.
- To determine if efflorescence has occurred, rub your thumb across the surface and if there is residue on your thumb that is gritty or talky, it is efflorescence.

After Finish Application

- Try to remove finish coat with putty trowel to see if it is bonded.
- The delamination may begin as a blistered or bubbled appearance during a rainfall. When it dries it may shrink and be unnoticeable or it may delaminate. After a series of rainfalls the extent of delamination will increase. The delaminated finish is usually brittle and flaky. This should not be confused with "surfactant leaching" whereby specialized soaps (the surfactant) used in EIFS material formulations deposit themselves on the surface of newly finished EIFS. These surfactants tend to disappear after repeated wetting soon after construction.

Avoiding Efflorescence

"Priming is a recommended practice..."

- Priming is a recommended practice not only to minimize the potential for efflorescence to develop, but also to provide uniform substrate absorption and finish colour, improve adhesion and water resistance.

  An acrylic primer will form a thin, continuous polymer film that will retard liquid moisture transport thereby blocking escape of calcium hydroxide to the surface, while allowing carbon dioxide to pass through the film and form a plug of calcium carbonate within the capillaries. This film would also serve as a barrier to moisture from external sources to combat secondary efflorescence.

- During construction, all walls should be kept dry by covering with a strong, waterproof membrane at the end of each workday or shutdown period.

- Provide adequate hydration of EIFS materials containing cement by protecting walls from cold temperatures, premature drying, or improper use of admixtures. Best practices are to provide temporary protection to avoid direct sunlight, windy conditions, rain and high humidity. Protect wall surfaces from these conditions until the cementitious products are cured/ dry.

- Use correct amounts of clean mixing water free from harmful amounts of acid, alkali's, organic material, minerals and salts. Avoid saltwater or brackish water. Never use contaminated mixing equipment. Over watering may dissolve more salts and result in heavier efflorescence.

Efflorescence on finish coat

Removal

"...lightly scrub the surface with a soft bristle brush followed by a rinsing of water."

Removal of efflorescence is relatively easy. If the situation allows, let efflorescence run its course and then remove it from the wall without using water. This is particularly true in cool, damp weather where introducing more water into the wall may increase efflorescence. In warm, dry weather, water can be used to rub off the efflorescence.

Water and Scrubbing

It's likely not practical to delay application of the finish coat. In these situations, the first method to remove efflorescence should be to lightly scrub the surface with a soft bristle brush followed by rinsing with water. Allow area to dry thoroughly before application of additional EIFS products.

Vinegar

The use of vinegar has also proven successful in the removal of salts. Use with 1-part water and 1-part vinegar with vinegar only to reduce scrubbing required.

Acid Cleaning (not preferred)

If water and dry brushing are not successful, it may be necessary to use a diluted acid cleaner such as:

- hydrochloric acid – Sure Klean No. 600 Detergent (1 part to 20 parts water)
- muriatic acid (1 part to 20 parts water
- Max Products 2112 efflorescence remover
- other cleaner as recommended by the EIFS manufacturer

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Prior to application of the acid cleaner, pre-wet the surface to limit the depth of penetration. A pressure washer may be used at low pressure (100-150 psi).

Use cleaners only as recommended by the EIFS manufacturer*. Do not use a pressure washer to applying cleaning solution. During cleaning, the surface will fizz indicating that the salts are being dissolved. It may be necessary to use a soft bristle brush to lightly scrub after cleaner application (wait approximately 5 minutes). Rinse all walls thoroughly with water immediately after treatment. Allow area to dry thoroughly before application of additional EIFS products.

**It is recommended to obtain manufacturer information from warranty documents, project specifications, or original homebuilder.*

Follow all safety precautions on the label and Material Safety Data Sheets. Protect all adjacent surfaces and comply with environmental regulations. Acid treatments should be first tested on a small area to ensure there are no adverse affects. Acid residue may also cause adhesion problems.

Acidic cleaning methods should not be used to remove efflorescence from the finish coat. The use of water, light scrubbing and vinegar are the most suitable methods.

Calcium carbonate efflorescence (hard white crush) is less common, but is difficult to effectively remove. The same cleaning methods noted above would still apply, some areas may need to be refinished due to damage to the surface texture when the crush is removed.

Technical Bulletins

This is one of a series of Technical Bulletins that the EIFS Council has produced to provide guidance concerning the building performance of EIFS installations. New bulletins, as well as updates of existing bulletins, are issued periodically, as necessary.

The bulletins do not create regulations; rather they provide specific guidance for complying with the minimum requirements of manufacturer's recommendations.

About the EIFS Council of Canada

The EIFS Council of Canada (ECC) was formed in 1987 to help focus attention and awareness on industry accepted practices and quality in the installation of EIFS claddings in the Canadian construction marketplace.

The development of an EIFS Quality Assurance Program (QAP) is expected to further enhance consumer protection through implementation of consistent guidelines and specifications for installers once its' development is complete and delivered to the marketplace.

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