

# Efflorescence and Masonry

## ***Cause, conditions, and removal techniques.***

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Efflorescence is a crystalline deposit of water-soluble salts (usually white) on the surface of masonry. All masonry materials are susceptible to efflorescence. Water-soluble salts that appear in chemical analysis in only a few tenths of one percent are sufficient to cause efflorescence on a masonry surface. The amount of salts and character of the deposits can vary widely, according to the nature of the soluble materials present and atmospheric conditions. Temperature, humidity, and wind affect efflorescence. In the summer, even after long rainy periods, moisture evaporates quickly and small amounts of salt or efflorescence are brought to the surface. Usually efflorescence is more common in the winter, when the slow rate of evaporation allows the migration of salts to the surface.

Efflorescence that occurs on new construction after the masonry dries is referred to as "new building bloom". New building bloom is generally an unsightly nuisance and no cause for concern, as it will normally weather off within a few months to a year. Efflorescence that persists in masonry walls and chimneys generally means that excess moisture is entering the system and (if not remedied) is a precursor to more serious damage.

Efflorescence producing salts are usually sulfates of sodium, potassium, magnesium, calcium, and occasionally iron and/or carbonates of sodium, potassium, and calcium. There have been over twenty different compounds identified as crystalline deposits on masonry walls. In mortar and concrete, the hydrated cement contains some calcium hydroxide (soluble) as an inevitable product of the reaction between cement and water. When this calcium hydroxide is brought to the surface by water and combined with carbon dioxide in the atmosphere it forms calcium carbonate, which appears as a whitish deposit. Some minerals such as vanadium, molybdenum and magnesium compounds, present in some ceramic units, may produce a greenish deposit, commonly referred to as "green stain". Occasionally, "brown stain" may occur, resulting from the deposits of manganese compounds.

## **Cause and Conditions**

Three conditions must exist before efflorescence will occur. First, there must be water-soluble salts present somewhere in the wall. Secondly, there must be sufficient moisture in the masonry to render the salts into a soluble solution. Thirdly, there must be a path for the soluble salts to migrate through the surface where the moisture can evaporate, deposit the salts and then crystallize. If any of these conditions is not present, efflorescence cannot occur.

## **Prevention**

Little can be done about the mineral make up or the path soluble salts may travel through an existing masonry wall. Solutions to solving efflorescence problems should focus on eliminating the source of moisture into the structure. In chimneys there are three major sources of moisture. Rainwater is the primary source of moisture that causes efflorescence in masonry chimneys; the problem is often compounded by cracks in the crown, mortar joints or masonry units. Poorly bonded or improperly filled mortar joints and faulty flashing are common sources of rainwater penetration as well. Another source of moisture that commonly occurs in masonry chimneys is condensation.

Water vapor, a natural byproduct of the combustion process, can often migrate through a system and condense within the wall. This is especially true in improperly vented high-efficiency gas furnaces in masonry chimneys and masonry chimneys with large chase areas. A third and often-overlooked source of moisture that can occur in masonry chimneys is groundwater. During heavy rains the water table may coincide with the ground surface. If the fireplace or chimney foundation does not have an adequate moisture barrier, moisture can be wicked up through the masonry by way of capillary suction. The cause of the moisture must be determined and corrective measures taken to keep water out of the chimney.

## Removal Techniques

Because moisture causes efflorescence it is generally best to remove efflorescence by dry methods such as brushing, vacuuming or light sand blasting. If dry removal methods are unsatisfactory, it may be necessary to wash the surface with a diluted muriatic acid solution: generally 12 parts water to 1 part commercially available muriatic acid. (Caution: acid resistant gloves, splash goggles and other protective clothing should be worn when using any chemical solution. Precautions on label should be observed because many chemicals can affect the eyes, skin and breathing). For integrally colored concrete masonry units or mortar, a more dilute solution (15:1) may be necessary to prevent surface etching that may reveal the aggregate and change colors and textures.

Before using any chemical to clean masonry, it should be tested in a small, inconspicuous area to be certain that there will be no adverse effect. When using any chemical cleaning compounds flood the surface with clean water to prevent the chemical from being absorbed deeply in the masonry work causing damage. Application should be to a small area, not more than three or four square feet at a time. Wait about five minutes before scouring off the salt with a stiff non-metallic brush. Immediately and thoroughly flush with clean water to remove all acid. Since an acid treatment may slightly change the appearance of treated areas, it is generally best to wash the entire chimney to avoid discoloration or mottling. Green stains, which more commonly occur on buff or gray brick from vanadium or molybdenum compounds or brown salts from magnesium, should never be treated with an acid. Acids will react with these compounds and produce an insoluble brown stain or salt that is extremely difficult to remove.

To remove "green stain" dampen masonry with clean water, then wash in same manner as above with a solution of 1 part, by volume, sodium hydroxide crystals (lye) and 10 parts water and thoroughly rinse with water. If chemical and water washing must be used it is best to do this in the summer when the water will evaporate quickly and not cause additional efflorescence formations.

Efflorescence that is not the result of "new building bloom" is often a visible sign of excessive moisture in a chimney system. Chimney professionals should examine the chimney system closely and offer the appropriate corrective measures. Early detection and prevention of moisture sources that cause efflorescence can save homeowners hundreds or even thousands of dollars in future repairs. ~

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