



Pass the Salt Please... Some Notes on Efflorescence

So what IS efflorescence?

Efflorescence is the deposit of water soluble salts resulting from a process which involves many different factors. When any one of these factors gets out of balance per se then efflorescence can occur. Weather, water chemistry, construction practice, masonry materials, structure design, and cleaning practice are some of the factors which influence whether or not an installation will effloresce. Typically the signature of efflorescence is a visible deposit of whitish salts or material near the grout joints which may continue to reappear even after cleaning. Similar to the white powder left in a drinking glass when a glass of water is left to evaporate, efflorescence is caused by minerals that are soluble in water being dissolved and transported to the surface of the grout as the water evaporates.

Is efflorescence always a salty affair?

Typically efflorescence is attributed to the deposit of salty substances but efflorescent substances may also include acids, bases, or colloidal gels. According to G.C. Robinson of the American Ceramic Society¹ “they may be crystalline substances of definite chemical composition or amorphous substances indefinite in composition. The word is used to label the substance and the process by which it was formed.”

Although efflorescent materials aren't *always* salt related many com-

mon efflorescent materials *are* salts. These include sulphates, chlorides, and bicarbonates which may be either alkali (sodium and potassium) or alkaline-earth salts of calcium, magnesium, and aluminum. Potassium and sodium sulfates are common efflorescing salts which can be washed away relatively easily due to their solubility; however calcium sulfate is insoluble in water or even in acid making it difficult to remove.

Where tile is involved, these efflorescent substances typically originate in the

cement slab below the tile or in the ground below the slab.

Occasionally, when tile is installed over a thick mortar bed, the mortar could provide a sufficient amount of soluble salts to cause efflorescence but only if moisture is regularly passing through the mortar bed. Porosity in the slab and grout facilitate the process of efflorescence by allowing the water and chemicals to travel more easily through the slab. Now with enough soluble salts or efflorescent chemicals present, plus enough water, and enough pressure to cause the water to migrate, those salts will be pushed to the surface. When the water evaporates, what remains is a precipitated crystalline residue or efflorescence.

Below: You can see the efflorescence (white deposits in the grout joints) on this exterior deck.



Where does the water come from?

Similar to the glass of water analogy, it takes a lot of water to dissolve enough minerals to be noticeable. Typically, cleaning does not provide enough water to cause efflorescence. Even saturating the grout joints with water during periodic cleaning generally does not cause efflorescence.

In exterior installations over concrete, rain can cause efflorescence over time when other conditions are right - especially with poorly compacted or porous grout.

More commonly, there can be moisture in the ground below the slab that is always evaporating. Even when a vapor membrane is installed below the slab, penetrations in the membrane may allow sufficient moisture to cause efflorescence. This moisture, invisible to eye, is steadily traveling through the slab, the tile cement, and the grout. And, as stated above, more efflorescence may be observed if the concrete and grout are more porous.

How do I minimize efflorescence?

There are generally effective ways to minimize this problem before tiling and some less effective options after the tile is in place.

Before tiling, if regular vapor migration is detected, remedial steps should be considered before tiling. This usually requires an assessment of the sources of moisture and other trades to effect the remediation. Reportedly, some manufacturers of anti-fracture membranes and/or uncoupling systems have effective systems for dealing with moisture migration up to specified limits. Also, there are companies that sell coatings claimed to reduce moisture migration - however, these may interfere with the ability of the tile cement to bond to the substrate and should only be used if both the manufacturer of the tile cement and the manufacturer of the coating will warranty the installation system.

After tiling, sealing the grout with a penetrating vapor permeable sealer may

help retard the rate of evaporation. Note, some caution must be observed in selecting the sealer - topical sealers (acrylic sealers) which coat the grout joint and are not vapor permeable may turn white from reactions between the acrylic and moisture - this is not efflorescence. Rather this is similar to the

whitish haze seen with floor wax when it is applied to a damp surface.

Now that it's here, how do I get rid of the stuff?

Generally efflorescence is removed with an acid. However, grout manufacturers do not advocate the use of acids

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because they attack the cement in the grout. Used judiciously though, this can be a highly effective way of removing efflorescence. There are several products on the market for this - with different acids and strengths. In all cases, extreme care should be used to protect the person applying the acid and surrounding fixtures. Generally, it is best to employ an experienced professional for this type of work. Also, acid that is too strong can strip some color out of grout (which is also undesirable) and acid generally cannot be used if acrylic sealers have already been applied to the grout.

After successfully removing the efflorescence, it can only reappear if

moisture is entering the system. At this point, sealing the grout joints with a penetrating sealer may be recommended depending on the entire tile assembly. The sealer will minimize water entering from above (from rain for example) and slow down the rate of evaporation of the water entering from below. However, they should not be used if a water-sensitive material (like mastic and some self-leveling products) was used in the tile assembly, and there is water migration through the substrate. **TILE**

¹ "A Primer on Efflorescence" Gilbert C. Robinson - American Ceramic Society Convention Talk - May 1995.

About the Author



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TCNA is a publisher of the American National Standards Institute's (ANSI) Specifications for the Installation of Ceramic Tile and the TCNA Handbook for Ceramic Tile Installation, the industry's guidelines for ceramic tile installation.

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