

FIELD REPORT # 0710

RE: Efflorescence

NOTE: The purpose of this field report is only to identify what efflorescence actually is, its source and suggestions how to prevent its occurrence.

In appearance, efflorescence is a whitish powder or crust that appears on the surface of brick, some tiles, grout and concrete. Chemically, these are white crystalline deposits composed of salt, lime and/or other minerals. The most common source of these salts is from a Portland cement based material or from elements present in some types of soil.* These chemicals can become soluble when water is present to dissolve them. Then through either evaporation, hydrostatic pressure, osmosis or some similar force, these cause the water-salt solution to migrate to the surface. (Evaporation = capillary process, wick action; Hydrostatic pressure = water from below; Osmosis = forcing the solution to seek cool air.) Once on the surface, air evaporates the moisture depositing the salts and minerals on the surface as a whitish powder. Although aesthetically unpleasant, generally this white powder is harmless except for its appearance.

* The earth is predominantly made up of oxygen, silicon, metals and minerals. When two or more of these elements are mixed with water they will dissolve and liquify. They create heat by themselves or draw heat from outside sources. This begins the process of osmosis, forcing the solution to seek cool air, usually on the surface. During the cooling process, hydration takes place leaving the residue of white powder on the surface, efflorescence. The presence of excessive silicon can be a problem, because it can react chemically with certain metals forming silicates, which are more difficult to remove.

Efflorescence is affected by temperature, humidity and wind. In the summer, moisture evaporates quickly so only small amounts of salt can be brought to the surface. It is usually in the winter when water evaporates more slowly that this condition is most common. This white powder on or near the surface is usually called 'alkali-salts' or 'lime-salts.' Salt is a mineral and pure salt minerals can be washed away with clean water. Alkali consists of one or more oxidized metals. Lime is an oxide of the metal calcium, and is the most common alkali. This alkali can be removed with phosphoric or sulfamic acid. Under no circumstances ever use muriatic acid, as it will always do more harm than good. For silicates, caustic soda mixtures have been used with some success in removing them from a surface.

To sum up the cause of efflorescence, three conditions must exist in order it to take place. If any one of these three is eliminated, the problem will not appear.

- 1- There must be soluble salts present.
- 2- Water must be present to dissolve the salts and carry them to the surface.
- 3- Either evaporation, hydrostatic pressure, osmosis or some similar force must cause the water-salt solution to migrate to the surface.

Conversely, to prevent efflorescence:

- 1- **ELIMINATE** soluble salts in the basic materials including using clean water.
- 2- **ELIMINATE** moisture – **OR**
- 3- **ELIMINATE** the passage of moisture through the setting bed or grout joints.

For additional information for removing efflorescence and silicates, contact CTMA member sealer or thin-set manufacturers for details. Their numbers are listed on CTMA's web site, www.concretetile.org.