

Efflorescence

Efflorescence is usually a white-coloured deposit that can form on the outer surface of paving. Often it occurs during construction or just after construction is finished, and although unpleasant, it is harmless. Efflorescence, or crystalline overlay, is a problem for all concrete producers.

Deposition is caused by a combination of circumstances: firstly, the presence of soluble salts in the material; secondly, the presence of moisture that dissolves these salts; thirdly, hydrostatic pressure or evaporation causes the solution to move towards the outer surface; and fourthly, the solution evaporates, leaving salt residues on the surface. One tenth of a percent of salts is enough to produce efflorescence.

Efflorescence is particularly affected by humidity, temperature and wind. In summer, even after a long period of rain, the moisture evaporates rapidly due to the air temperature and a relatively small amount of salt is brought to the outer surface. Efflorescence is more common in winter, when slower evaporation brings more salt to the outer surface. In the absence of an external source of salt, salt excretion becomes less extensive over time. Light-coloured surfaces show much less deposition than darker ones.

Any salt that gets into the paving can cause efflorescence. Salt compounds coming mainly from the inside to the outer surface can react with compounds present in the surrounding environment to form a deposit. The most common cause of deposition is the leakage of slaked lime (Calcium hydroxide – the inevitable product of the reaction between cement and water) from the concrete to the surface (primary efflorescence) or the formation of a lime layer on the concrete surface caused by rainfall (secondary efflorescence). On the surface, calcium hydroxide reacts with carbon dioxide in the air to form an insoluble calcium carbonate. After a period of time (about 1 year), the calcium carbonate on the surface of the concrete reacts again with carbon dioxide and other acid residues in the air to form the water-soluble calcium hydrogen carbonate $\text{Ca}(\text{HCO}_3)_2$. Thus, efflorescence is again “washed off” in outdoor conditions.

Another source of salts is the ground in contact with the paving.

As formation of efflorescence is caused by many factors, it is difficult to say if and when it occurs.

Efflorescence will not occur if:

- soluble salts are eliminated
- moisture has been removed
 - the movement of water is blocked

The loss of salts is influenced by:

- intensity of use (high intensity of use in urban streets)
- time (after some time, the signs of efflorescence disappear)
- moisture (efflorescence lasts longer in shade under trees)
- weather (abundant rainfall reduces the occurrence of efflorescence)

Removal of efflorescence

If efflorescence is present, the source of efflorescence must be identified and measures taken to keep water out of the structure.

Most of efflorescence can be removed by dry brushing, rinse brushing, pressure washing or light sand spraying, followed by rinsing with clean water.

If this is not sufficient, it may be necessary to wash the surface with a diluted solution of hydrochloric acid (1–10%). For coloured paving, use hydrochloric acid solution with a concentration of up to 3% to prevent changes in colour and texture as a result of etching.

A solution of 1 part vinegar and 5 parts water could also help. Also consult façade cleaning companies.

Before using acid, always wet the surface with clean water to prevent the acid from penetrating deep into the paving where it can cause damage. Clean a small area at a time, no more than 1 m², then wait about 5 minutes and scrub the surface clean with a hard brush. After such treatment, the surface must be rinsed immediately and thoroughly with clean water to remove all acid residues.

It is often helpful to identify the types of salts that cause efflorescence in order to find a suitable solution. The method should be tested on a small unnoticeable area before cleaning the entire pavement. Since acid and other treatments can slightly alter the appearance, it is advisable to treat the entire surface.