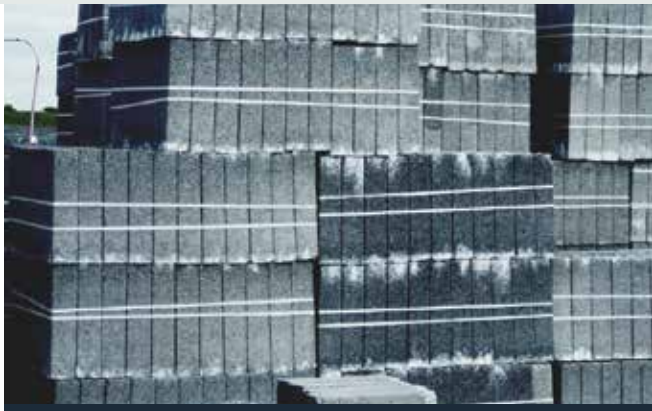
EFFLORESCENCE REDUCTION TECHNICAL ADVISORY NOTE

Efflorescence is the white staining that forms on the surface of concrete products such as blocks and paving and can also be apparent in mortar.

It is unsightly and can readily spoil the look of mortar, concrete, brickwork or paving, particularly where the decorative properties are very important. It is an aesthetic flaw and is not an indication of a performance defect. It is usually associated with products that are porous and allow for the movement of moisture. GGBS is a by-product from the production of iron and is used as a direct replacement for Ordinary Portland Cement to produce stronger, more durable, low carbon concrete. Due to the whiter colour GGBS is often specified in architectural concrete for its superior finish.

I.S EN 206 "Concrete – Part 1: Specification, Performance, Production and Conformity" Standard allows for a direct replacement of Ordinary Portland Cement by GGBS up to a limit of 70% with a CEM I or CEM II. The unique properties of GGBS helps reduce the occurrence of efflorescence, ensuring the intended finish of your job is achieved.



TYPES OF EFFLORESCENCE

- Primary Efflorescence
- Secondary Efflorescence
- Cryptoflorescence

MECHANISMS OF EFFLORESCENCE FORMATION

Efflorescence is mainly caused by the formation of insoluble calcium carbonate ($CaCO_3$) that appears as a white bloom diffused over on area or as a hard white crust. The formation of calcium carbonate is due to chemical reactions between atmospheric CO_2 and calcium hydroxide $Ca(OH)_2$ that is produced from portland cement hydration.

Primary efflorescence arises from the transportation of a solution of water and dissolved salts including $Ca(OH)_2$ from within, through the capillary pores of the concrete and mortar to the exposed surface.

The water evaporates when the solution reaches the surface leaving the fuel for efflorescence, the calcium hydroxide $Ca(OH)_2$, exposed on the surface where is it is likely to react with CO_2 and result in the undesirable white staining - efflorescence.

Secondary efflorescence arises when external water from rain or groundwater penetrates the hardened surface of concrete products or mortar and reacts with any un-hydrated calcium hydroxide $Ca(OH)_2$, which can then start the process of calcium carbonate formation.

Cryptoflorescence is another form of efflorescence that is caused by salt crystallisations within the pore structure of the concrete. It forms below the surface and is not visible unless the crystal growth is sufficient to cause surface scaling. Pigments may introduce extra salts that can increase the risk of this form of efflorescence.

THE BASIC HYDRATION OF PORTLAND CEMENT:

Portland cement + water → $Ca(OH)_2$ + CSH

CALCIUM CARBONATE FORMATION:

$Ca(OH)_2$ (dissolved) + CO_2 (dissolved) → $CaCO_3$ (solid) + H_2O (liquid)

FOR SMALLER PROJECTS

Ecocem Next Generation Cement, available in 25kg bags, is a unique blend of GGBS and traditional cement that is suitable for use in all applications from mortar and render to concrete and screeds.

A certified CEM III/A , Ecocem bagged cement will provide the same efflorescence reduction as bulk GGBS usage that was previously only available for concrete products.

THE ROLE OF ECOCEM GGBS AND CEMENT IN EFFLORESCENCE PREVENTION

It is said that prevention is better than cure and this is certainly true for efflorescence where the remedies include wire brushing, jet washing, sand blasting and washing with acid.

The two key factors to prevent efflorescence are to reduce the amount of calcium hydroxide $Ca(OH)_2$ and to reduce the permeability of the product to minimise the ability of water and salt solutions to migrate to and from the surface. By replacing Traditional cement with Ecocem GGBS you are immediately removing a direct proportion of calcium hydroxide $Ca(OH)_2$ in a mix as Ecocem GGBS hydration does not produce any calcium hydroxide $Ca(OH)_2$.

Further calcium hydroxide reduction and possibly elimination occurs as the hydration of Ecocem GGBS consumes calcium hydroxide and produces calcium silicate hydrate (CSH) which reduces the permeability of products by filling up the capillary pores and increases strength. Reducing the permeability also increases the durability of the products to attack by salt, sulphates, acids and the action of freezing and thawing.

THE BASIC HYDRATION OF GGBS:

GGBS + water > $Ca(OH)_2$ + CSH

CERTIFICATION

Ecocem has been rigorously tested in accordance with the EN 197-2 Cement - Part 2: Conformity evaluation and the EN 15167-2: Ground Granulated Blast furnace Slag and has been issued with an EC certificate of conformity by an EU Notified Body and carries the CE mark.

HEALTH & SAFETY OHSAS 18001:2007 NSAI Certified

CEMENT I.S. 197-1:2001 NSAI Certified

ENVIRONMENT I.S. EN ISO 14001:2015 NSAI Certified

QUALITY I.S. EN ISO 9001:2015 NSAI Certified

GROUND GRANULATED BLASTFURNACE SLAG I.S. EN 15167-1:2006 NSAI Certified

BES 6001 Responsible Sourcing www.greenbooklive.com

FSC

Innovation Powering Sustainability

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