ROLE OF CONSTRUCTION CHEMICALS IN CONCRETE PROTECTION

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ABSTRACT

Contemporary concrete structures have to perform in a variety of severe exposure conditions. If left unprotected, the service life of these structures is curtailed considerably owing to the deterioration caused by the aggressive elements.

Concrete technology has advanced a long way from the ages-old design concept of Abraham's water-cement ratio law. However, its basic ingredients still remain the same. Experience has shown that concrete produced from only its basic ingredients (cement, aggregate and water) offers limited resistance to the damaging influence of physical and chemical attacks. It is the broad range of construction chemicals which are now available that help to improve concrete durability by incorporating a number of performance-enhancing functions both in the plastic state and the hardened state of concrete. Some of these chemicals form an intergral part of the concrete mixture while the rest are applied on the finished surface.

This paper descibes the benefical influence of construction chemicals like admixtures, curing compounds, hydrophobic materials, wetting agents and surface treatment coatings in protecting concrete.

KEYWORDS

Construction chemicals, admixtures, curing compounds, hydrophobic materials, surface treatment.

Table 2 : Improvement in Tensile Strength and Flexural Strength of 1:3 Mortar by Latex Modification

Polymer-Cement Ratio (%)	Tensile Strength, N/mm^2		Flexural Strength, N/mm^2	
	PVA	SBR	PVA	SBR
0	2.78	2.78	3.32	3.32
5	3.46	3.93	4.97	5.57
10	4.13	4.96	6.2	7.01
15	4.68	5.58	6.89	7.94

Table 3 contains 90 day drying shrinkage values of a 1:3 mortar, measured as per ASTM C 157 [3]. Here again, it is clear that by latex-modification, the long term shrinkage is reduced by as 30% to 45% for an SBR content of 10% and 15% respectively.

Table 3 : Drying Shrinkage of SBR-Modified 1:3 Mortar

SBR-Cement Ratio (%)	Drying Shrinkage X 10^{-4}
0	13.2
5	10.7
10	9.1
15	7.2

Curing Compounds :

Concrete may attain only a fraction of its potential ultimate strength when not adequately cured. Curing is therefore extremely important for concrete to perform well in its service life. A properly cured concrete exhibits less shrinkage and also less cracking associated with it. The ideal method of curing is to keep the concrete surface moist and to control its ambient temperature for as long as is practicable. Where field conditions prohibit such a curing procedure, liquid solutions based on chemical compounds can be sprayed onto freshly placed concrete to act as curing agent's. These solutions are either water based or solvent-based and mostly contain organic polymeric substances. On drying, the concrete surface prevents moisture to evaporate from within its mass. After a few weeks, the curing film disintegrates itself without causing any damage to the concrete surface.

Surface Treatment :

Many concrete technologists are of the view that durability of concrete is 'skin deep', i.e. the density and impermeability of the concrete near the surface (and hence the concrete cover to steel reinforcement) hold a key to the prevention of ingress of deleterious and harmful substances which either damage the concrete or cause steel reinforcement to corrode leading ultimately to the failure of reinforced concrete structure.

Sealing the surface with penetrating sealers based on siloxanes, silanes and methyl-methaerylates has been employed as a method of combatting the penetration of water and other aggressive elements into concrete. The impregnating chemical fills the pores and introduces water-repellency and hydrophobic characteristics near the concrete surface. As a result the concrete durability is substantially enhanced owing to the improved resistance to moisture penetration.

Joint Sealant :

Hardened concrete expands or contracts depending on the rise or fall of the ambient temperature. If the exposed surface area is large, joints are provided at regular intervals to prevent damage due to excessive dimensional instability. These joints are gaps between successive concrete castings and need to be filled. The primary function of a joint, other than allowance for shrinkage and deviation from design dimension, is to allow the structure to move freely without any damage to the concrete due to change in weather. These joints may be either movement joints or non-movement joints but they must be sealed to protect the building from environmental attack. A modern sealant is that material which is applied in an unformed state to a joint, seals it by adhering to the joint surfaces. Some of the main functions of a sealant are :

* To accomodate thermal movement of joints.
* To exclude rain, snow, dust / dirst and wind from the interior of a building.
* Exclusion / Retention of water or liquid.
* In horizontal joints (floors) prevent the ingress of anything that would interfere with movement causing damage to building component including concrete.
* To exclude chemical or biological contaminants from the joints in the interest of preserving the structure from chemical attack.

There are a large number of single and multiple component sealants available in the market. They are primarily based on synthetic polymer such as silicone, polyurethane and polysulfide. Single componenets sealants are slow curing in comparison with multi-pack products. Selection of a suitable sealant for specific application is very important for its optimum peformance.

Conclusion :

Construction chemicals have a significant role to play in improving the properties of concrete both in tis plastic state and the hardened state. By incorporating admixtures, pozzolans and latexes, not only the concrete strength is increased but also its resistance to the penetration of external aggressive elements is enhanced. Concrete servieability is improved further by the application of curing compounds and sealants on its exterior surfaces.

References :

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