

Self Curing Concrete by Potential Methods of Internal Curing with the Polyethylene Glycol

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ABSTRACT: Recent advancement in Engineering and Technology and Management we will discuss about **Self Curing Concrete**. The imagination of a world without concrete is impossible. Concrete is a soul of infrastructures. Concrete is necessary to gain strength in structures. Conventional concrete, which is the mixture of cement, fine aggregate, coarse aggregate and water, needs curing to achieve strength. So it is required to cure for a minimum period of 28 days for good hydration and to achieve target strength. Lack of proper curing can badly affect the strength and durability. Self-curing concrete is one type of modern concrete, which cure itself by retaining water (moisture content) in it. The use of POLYETHYLENE GLYCOL in conventional concrete as an admixture helps better hydration and hence the strength of concrete

KEYWORDS: Self curing concrete, Internal curing, Poly Ethylene Glycol

I. INTRODUCTION

The recent trend in concrete technology toward the so-called high-performance, or low water/solid binder mass ratio (w/b), concretes encountered some problems. One of the major problems with such a mixture is its increased tendency to Definition of

Undergo early-age cracking. While this cracking may or may not compromise the (higher) compressive strength of these concretes, it likely does compromise their long-term durability. The phenomenon of early-age cracking is complex and depends on thermal effects, autogenous strains and stresses, drying, stress relaxation, and structural detailing and execution. In concretes with low w/binder ratio, a major contributor to early-age cracking can be the autogenous shrinkage induced by the self-desiccation that occurs during hydration under sealed or partially saturated conditions. As the cementitious materials hydrate under sealed conditions, empty porosity is created within the "set" microstructure, because the hydration products occupy less volume than the reacting materials. The water menisci created by these empty pores in turn induce compressive stresses in the three-dimensional microstructure. The magnitude of these stresses is influenced by both the surface tension of the pore solution and the meniscus radius of the largest water-filled pore within the microstructure. Concrete incorporating self-curing agents will represent a new trend in the concrete construction in the new millennium, due to the increased use of high-performance concrete. Several techniques may, potentially, be used for incorporation of internal curing water in concrete. Several researchers have proposed the use of saturated light weight aggregates to provide "internal" curing for concrete. On the other hand, other researchers used poly-glycol products in concrete mixes as self curing agent.

II. MECHANISM AND SIGNIFICANCE OF SELF CURING CONCRETE

Continuous evaporation of moisture takes place from an exposed surface due to the difference in chemical potentials (Free energy) between the vapour and liquid phases. The polymers added in the mix mainly form hydrogen bonds with water molecules and reduce the chemical potential of the molecules which in turn reduces the vapour pressure, thus reducing the rate of evaporation from the surface. When the mineral admixtures react completely in a blended cement system, their demand for curing water (external or internal) can be much greater than that in a conventional ordinary Portland cement concrete. When this water is not readily available, significant autogenous deformation and (early-age) cracking may result. Due to the chemical shrinkage occurring during cement hydration, empty pores are created within

the cement paste, leading to a reduction in its internal relative humidity and also to shrinkage which may cause early-age cracking.

Why the self Curing Concrete required

Sometimes works are carried out in place where there is acute shortage of water and the application of water curing is not possible for reasons for economical.

Prevention of moisture loss from the surface of flat concrete works such as high ways and airports have been challenging tasks to Engineers.

Advantages of Self Curing Concrete

1. Reduces the autogenously cracking
2. Largely eliminates autogenously shrinkage
3. Reduces permeability
4. Protects reinforcement of steel
5. Provide greater durability
6. Increases the early age strength
7. Improved rheology
8. Lower maintenance
9. Higher performances
10. Doesn't not adversely effects in finish ability

III. TYPES OF SELF CURING CONCRETE

There are two Major methods are available for internal curing method.

The first method uses saturated Porous light weight Aggregate.

The second method uses Ploy – Ethylene Glycol (PEG) which is reduces the evaporation of water from the surface of concrete and also helps in water retention.

Internal Curing (IC)

The ACI-308 Code states that “internal curing refers to the process by which the hydration of cement occurs because of the availability of additional internal water that is not part of the mixing Water.” Conventionally, curing concrete means creating conditions such that water is not lost from the surface i.e., curing is taken to happen ‘from the outside to inside’. In contrast, ‘internal curing’ is allowing for curing ‘from the inside to outside’ through the internal reservoirs (in the form of saturated lightweight fine aggregates, superabsorbent polymers, or saturated wood fibers) Created. ‘Internal curing’ is often also referred as ‘Self-curing.’

Potential Materials for Internal Curing (IC)

The following materials can provide internal water reservoirs

Lightweight Aggregate (natural and synthetic, expanded shale)

Super-absorbent Polymers (SAP) (60-300 nm size)

SRA (Shrinkage Reducing Admixture) (propylene glycol type i.e. polyethylene-glycol)

Advantages of Internal Curing

Internal curing (IC) is a method to provide the water to hydrate all the cement, accomplishing what the mixing water alone cannot do. In low w/c ratio mixes (under 0.43 and increasingly those below 0.40) absorptive lightweight aggregate, replacing some of the sand, provides water that is desorbed into the mortar fraction (paste) to be used as additional curing water. The cement, not hydrated by low amount of mixing water, will have more water available to it.

- IC provides water to keep the relative humidity (RH) high, keeping self-desiccation from occurring.
- IC eliminates largely autogenous shrinkage.
- IC maintains the strengths of mortar/concrete at the early age (12 to 72 hrs.) above the level where internally & externally induced strains can cause cracking.

- IC can make up for some of the deficiencies of external curing, both human related (critical period when curing is required is the first 12 to 72 hours) and hydration related (because hydration products clog the passageways needed for the fluid curing water to travel to the cement particles thirsting for water). Following factors establish the dynamics of water movement to the unhydrated cement particles:
 - i. Thirst for water by the hydrating cement particles is very intense,
 - ii. Capillary action of the pores in the concrete is very strong, and
 - iii. Water in the properly distributed particles of LWA (fine) is very fluid.

Polyethylene Glycol

Polyethylene glycol is a condensation polymer of ethylene oxide and water with the general formula $H(OCH_2CH_2)_nOH$, where n is the average number of repeating oxyethylene groups typically from 4 to about 180. The abbreviation (PEG) is termed in combination with a numeric suffix which indicates the average molecular weights. One common feature of PEG appears to be the water-soluble nature. Polyethylene glycol is non-toxic, odorless, neutral, lubricating, non-volatile and non-irritating and is used in a variety of pharmaceuticals

Table: Casting Intakes

Ingredients	Unit	A	B	C	D
Water	l/m ³	191.6	191.6	191.6	191.6
Cement	Kg/m ³	426	426	426	426
Fine Aggregate	Kg/m ³	498	498	498	498
Coarse Aggregate	Kg/m ³	1361.8	1361.8	1361.8	1361.8
Water Cement ratio	By mass	0.45	0.45	0.45	0.45
Poly Ethylene Glycol	%	0	0.5	1	1.5
Poly Ethylene Glycol	l/m ³	0	2.13	4.26	6.39

IV. CONCLUSION

Strength of self-curing concrete is relatively high when compared with conventional concrete. It is the viable answer to many problems faced due to lack of proper curing. It is an alternative to conventional concrete in desert regions where scarcity of water is a major problem.

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