Strength Properties of Concrete using Polyethylene Glycol (PEG-600)

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Abstract— Excessive evaporation of water (internal or external) from fresh concrete should be avoided; otherwise, the degree of cement hydration would get lowered and thereby concrete may develop unsatisfactory properties. Curing operations should ensure that adequate amount of water is available for cement hydration to occur. This paper discusses different aspects of achieving optimum cure of concrete without the need for applying external curing methods.

Key words: Concrete, Polyethylene Glycol (PEG-600)

I. INTRODUCTION

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.'

The construction industry uses a lot of water in the name of curing. The days are not so far that all the construction industry has to switch over to an alternative curing system, not only to save water for the sustainable development of the environment but also to promote indoor and outdoor construction activities even in remote areas where there is a scarcity of water.

II. MATERIALS

The Ordinary Portland cement of 43-grade PPC was used in this study conforming to IS 12269-1987. The river sand is used as fine aggregate conforming to the requirements of IS: 383-1970. Coarse aggregate obtained from local quarry units has been used for this study, conforming to IS: 383-1970 is used. The aggregates were tested as per IS 2386-1963. The water used for experiments was potable water conforming as per IS: 456-2000. Polyethylene Glycol-600(PEG-600) the polymers added in the mix mainly form hydrogen bonds with water molecules and reduce the chemical potential of the molecules of water which in turn reduces the vapor pressure, thus reducing the rate of evaporation from the surface.

Appearance	Clear liquid or white solid
Odour Solubility Density range	Mild odour Soluble in water 1.1 to 1.2 (increases as molecular weight increases)

Table 1: Physical & Chemical Properties — Polyethylene Glycol

III. METHODOLOGY

The collection of material for the self-curing concrete such as PEG 600 are obtained and for M20 concrete mixes were collected and cast. M20 Grade mixes were designated in accordance with IS: 10262-2009. Conventional concrete was cast with M20 mix and made to water curing. Another set of cubes were cast using 1% and 2% PEG-600, with M20 concrete and allowed for atmosphere curing. Similarly, cubes were cast for 7 and 28 days for conventional and PEG 600 to study the strength properties (compressive strength and split tensile strength). For this experimental study, a total of 18 cubes and 18 cylinders were cast for determining the strength properties.

IV. RESULTS & DISCUSSION

The compressive and split tensile strength of M20 grade concrete mix for 1%, 2.0% of PEG-600 and conventional concrete is discussed below.

- For M20 concrete the compressive strength at the end of 7 and 28 days for 1.0% addition of PEG-600 the compressive strength showed an increasing value of 29.33 and 37.77 N/mm^2 as shown in Table.2.
- For M20 concrete the compressive strength at the end of 7 and 28 days for 2.0% addition of PEG-600 the compressive strength showed an increasing value of 26.22 and 31.55 N/mm^2 as shown in Table.2.
- Similarly, for M20 concrete the split tensile strength at the end of 7 and 28 days for 1.0% of addition of PEG-600 the split tensile strength showed an increasing trend of 10.22 and 12.88N/mm^2 as shown in Table.3.
- Similarly, for M20 concrete the split tensile strength at the end of 7 and 28 days for 2.0% of addition of PEG-600 the split tensile strength showed a decreasing trend of 7.77 and 9.55 N/mm^2 as shown in Table.3.

% of PEG-600	Compressive strength (N/mm^2)	
	7 Days	28 Days
0%	15.2	28.5
1%	29.33	37.77
2%	26.22	31.55

Table 2: Compressive Strength of Cubes with Varying % of PEG 600

% of PEG-600	Split tensile strength (N/mm^2)	
	7 Days	28 Days
0%	8.8	10.66
1%	10.22	12.88
2%	7.77	9.55

Table 3: Split Tensile Strength of Cylinder with Varying % of PEG 600

V. CONCLUSION

The Compressive strength was found to increase with the addition of 1.0% of PEG-600 in M20 grade of concrete as well as the split tensile strength. The Compressive strength

was found to increase with the addition of 2.0% of PEG-600 in M20 grade of concrete. Hence self-curing concrete showed a better performance with respect to its compressive strength but split tensile strength showed less impressive results. Thus Self-cured concrete is thus found to be less porous compared to the conventional types. It shows that the self-curing concrete is able to withstand extreme conditions and corrosion effects. Viewing the above strength characteristics properties, it can be concluded that self-curing concrete is a better option in field conditions where there is a scarcity of water.

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