# EXPERIMENTAL STUDY ON SELF CURING CONCRETE USING NATURAL AND RECYCLED COARSE AGGREGATE

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## ABSTRACT

*A self-curing concrete is provided to absorb water from atmosphere to achieve better hydration of cement in concrete which solves the problem of lowered cement hydration because of improper curing and thus unsatisfactory properties of concrete. The present investigation involves the use of self-curing agent viz., polyethylene glycol (PEG) of molecular weight 6000 (PEG 6000) for dosages ranging between 0.5 to 2% by weight of cement added to mixing water. The experimental program was planned as the following. Total 120 cubes, 120 cylinders, 120 prisms were cast which involves different dosages (0%, 0.5%, 1% and 2%) of self-curing agent PEG-6000 for four different mixes (Mix 30 and Mix 40), under different curing conditions (indoor, conventional) with different aggregates (normal coarse aggregate and recycled coarse aggregate). Comparative studies were carried out for self curing of recycled coarse aggregate and self curing of normal coarse aggregate. Comparative studies were carried out for water retentivity, compressive strength, split tensile strength, flexural strength for 7 days and 28 days for conventional cured and self-cured concrete. The properties of self-cured concrete are at least comparable and some time better than those of concrete with traditional curing. The comparative studies for strength were carried out at different dosages for different coarse aggregate. The results indicate that selfcuring concrete has shown greater strength compared to conventional curing concrete. The maximum strength for normal coarse aggregate concrete is at dosage of 2% SCA and for recycled coarse aggregate concrete is at dosage of 1% SCA and then decreases. For concrete using normal coarse aggregate in place of Recycled coarse aggregate the compressive strength was found to be 7.5% more at 28 days. The compressive strength of self curing concrete is 3% more then that of the concrete with conventional curing curing 28 days.*

*Similarly the spilt tensile strength with normal coarse aggregate was found to be 7% more then with recycled coarse aggregate at same 28 days testing. Again the split tensile strength was found to be 3.1% more then the concrete with conventional curing at 28 days testing. The flexural strength 5% is more for natural coarse aggregate concrete compared to recycled coarse aggregate concrete 28 days. The flexural strength 2% more for selfcuring concrete compared to the conventional curing concrete for 28 days. The maximum weight loss in the concrete occurs at 0% of SCA and increases with increases in percentage of SCA.*

**Keywords:** *Self Curing Agent, PEG 6000, Recycled Coarse Aggregate, OPC, Curing.*

## I. INTRODUCTION

### 1.1) Curing

Balancing the rate and volume of transpiration from concrete through cement hydration is identified as curing. It could be either after it has been set in situ (or when making concrete products), allowing enough time for the cement to hydrate. If concrete is to reach its full durability and strength potential, curing must be done for a suitable amount of time because cement hydration takes several days or weeks instead of hours. Due to its effect on how soon cement hydrates, temperature regulation may also be incorporated into the definition of curing. The required qualities of the concrete, the intended application, and the environmental conditions, such as the air's temperature and relative humidity, may all affect the curing period.

**Conventional Curing Methods**

Following are some general categories for concrete curing techniques:

i. Reduce the escape of moisture from the concrete by, for instance, by overlaying it with an outer layer that is largely impermeable.

ii. Oven curing and Steam curing.

iii. Continue misting the concrete's exposed surface in order to avoid moisture loss.

iv. Ponding or water spraying the surface.

Challenges with the Traditional Curing

i. It is not possible to maintain the surface moisture for the vertical element as it is for flat surfaces.

ii. In areas where there is a water shortage.

iii. In locations where physical curing is not feasible.

### 1.2. Self Curing

Curing entails maintaining the early stages of concrete at an appropriate moisture level so that it can develop the required properties. Good healing, however, is not necessarily practical in many circumstances. Many researchers looked into the viability of producing self-curing concrete (SCC). Thus, the requirement to create self-curing chemicals attracted a number of researchers. The idea behind self-curing compounds is to boost concrete's ability to retain water by reducing the amount of water that evaporates from it as compared to regular concrete. It was discovered that water soluble polymers might be employed in concrete as self-curing agents (SCA). Concrete's durability and performance are enhanced by curing because it has a significant impact on how the material develops its pore structure and microstructure. The idea behind self-curing compounds is to boost concrete's ability to retain water by reducing the amount of water that evaporates from it as compared to regular concrete. Since each cubic metre of concrete takes around 3 cubic metres of water for production, the majority of which is used for curing, the use of self-curing admixtures is crucial.

### 1.3. Definition of self-curing

It has long been believed that concrete cures "from the exterior to the inside" by establishing circumstances that prevent water from escaping beneath the surface. On the other hand, "internal curing" enables curing "from the inside to outside" by using the inside reservoirs that were created, such as saturated wood fibers, and lightweight fine aggregates. It's also common to refer to "internal curing" as "self-curing."

### 1.4. Potential Materials for self curing

The following materials, such as LWA 19mm Coarse, Lightweight Aggregate, Super-absorbent Polymers, LWS Sand, SRA, and Wood powder, can serve as internal water reservoirs.

### 1.5. Chemicals to Achieve Self–curing

If specific water-soluble additives are used during the mixing process to stop water evaporation from and inside the set concrete, concrete might start to "cure" on its own. In a normal cement matrix, the substances ought to be capable to improve the holding capacity of water and reduce solution evaporation. Some substances, such as polyethylene glycol (PEG), polyvalent alcohol, xylitol, sorbitol, poly-acrylic acid, glycerin phytosterols, stearyl alcohol, etc are hydrophilic in nature.

## 1.6 CLASSIFICATION OF AGGREGATES

The following categories are used in this report for organisational purposes.

### 1.6.1 Natural Aggregate

Construction aggregates include, for example, crushed river gravel, sand, crushed rock, and gravel which are extracted from natural resources like gravel and sand.

### 1.6.2 Manufactured Aggregate

A few examples of produced aggregates are expanded shale, clays, slate, polystyrene aggregate (PSA), fly ash aggregate, foamed blast furnace slag (FBS), manufactured sand, and by-products of manufacturing processes.

### 1.6.3 Recycled Aggregate

Reclaimed Aggregate (RA), Reclaimed Concrete and Masonry (RCM), Reclaimed Asphalt Aggregate (RAA), Glass Cullet, Reclaimed Asphalt Pavement (RAP), Utilised Foundry Sand, and Scrap Tyres are a few kinds of aggregates made from materials that had been utilised in construction.

### 1.6.4 Reused By-product

Aggregates made from industrial waste include, for example, Mine Tailings, Fly Ash (FA), Crusher Fines, Furnace Bottom Ash (FBA), Organic Materials, Incinerator Bottom Ash (IBA), Electric Arc Furnace Slag (EAF), Coal Washer Reject (CWR), Steel Furnace Slag (BOS), and Granulated BF Slag (GBS).

## 1.7 Sources of Recycled Aggregate

In the past, landfills have used Portland concrete aggregate from demolition projects. However, Portland concrete aggregate can now be employed as a new kind of building material. According to OPC concrete Recycling, crushed Portland concrete pavements and building materials are the principal source of recycled aggregates.

## 1.9 The Use of Recycled Aggregate In Concrete

An alternate coarse aggregate that is often mixed with ordinary coarse aggregate for use in novel concrete is crushed aggregate from either hardened residual concrete or demolition concrete. If not adequately regulated and monitored, the use of 100% recycled coarse aggregate in concrete is likely to have a detrimental impact on the majority of the characteries of concrete, including compressive strength (CS), creep, elastic modulus (EM), etc especially for higher-strength concrete.

## 1.10 Need of Present Work

Curing entails maintaining the early stages of concrete at an appropriate moisture level so that it can develop the required properties. Good healing, however, is not necessarily practical in many circumstances. Many researchers looked into the viability of producing self-curing concrete. Thus, the requirement to create self-curing chemicals attracted a number of researchers. In contrast to ordinary concrete, the idea behind self-curing chemicals is to increase the concrete's ability to retain water by reducing the amount of water that evaporates from it.

Self-curing concrete is an option to enhance cement hydration in concrete. It resolves the problem that insufficient or improper curing decreases cement hydration, resulting in undesired concrete properties.

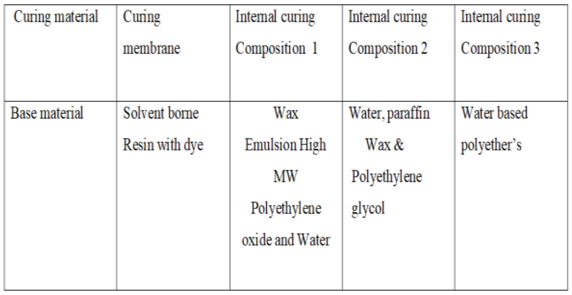
### 1.11 Mechanism of self-curing

The variation in chemical potentials among the liquid and vapour phases causes continual evaporation of water from a surface that is exposed, which is the basis for the self-curing process. The provided polymers work largely by creating hydrogen bonds with water molecules and reducing the chemical potential of the molecules to slowly decrease the rate at which water escapes from the outermost layer.

## II. LITERATURE REVIEW

**Roland et al., (2002) [1]**

The objective of the research was to produce self curing concrete by using hydrophilic chemicals like polyethylene glycol and paraffin wax. Many experiments have done on ordinary concrete like compressive strength at different days of curing and also at different proportions of PEG and wax. The investigation was done using three internal curing compositions and is as follows:-



| Curing material | Curing membrane | Internal curing Composition 1 | Internal curing Composition 2 | Internal curing Composition 3 |
|---|---|---|---|---|
| Base material | Solvent borne Resin with dye | Wax Emulsion High MW Polyethylene oxide and Water | Water, paraffin Wax & Polyethylene glycol | Water based polyether's |

**A.S. EL- DIEB (2007) [2]**

The aim of the study was to compare SCA to traditional concrete curing in order to determine the SCA potential for water holding, degree of hydration, and moisture transfer. This study used polyethylene glycol, a water-soluble polymeric glycol, as the SCA. By weight of cement, the SCA dosage was 0.02%. For all SCC mixtures, the dose was maintained at the same level. The study's objective was to examine concrete that had variable cement content at various water to cement ratios, including self–curing, air–curing concrete, and conventional to compare the results of various tests. According to the weight loss over time, it was discovered that SCA infused concrete mixes have higher ater retention than ordinary concrete mixes. Compared to ordinary concrete (OC), SCC saw less self-desiccation under sealed settings. In comparison to traditional concrete, SCC exhibited better hydration over time under drying conditions. SCC has a lower water transport than standard air-cured concrete. For SCC, water water permeability, and sorptivity values dropped over time.

**Wen egt al., (2008) [3]**

The study's goal was to determine how the use of high-performance SCA affected the strength properties of self-compacted concrete in compared to OC. In this investigation, polyvalent alcohol and polyacrylic acid (PAA) were used as the SCA. The nature of these two substances is highly hydrophilic. SCA dosages ranged between 1% and 2% by weight of cement. Tests on CS and water retention were conducted at relative humidity levels of 50%, 67.5%, and 85%. According to the weight loss over time, it was discovered that SCA infused concrete mixes have higher after retention than OC mixes. Compared to OC, SCC saw less self-desiccation under sealed settings. In comparison to traditional concrete, SCC exhibited well hydration over time under drying conditions. Self-curing concrete has a lower water transport than standard air-cured concrete. For SCC, water permeability and water sorptivity values dropped over time, indicating a decreasing proportion of permeable pores as a result of the cement's ongoing hydration. With this technology, the compressive strength (CS) of self- compacting concrete was greatly increased, often surpassing that of conventional moist curing. This proves that the SCC of this invention does not require a lengthy moist curing process, saving money and ensuring greater quality and a higher CS.

**Collepardi [5]**

This study work's goal was to create a drying shrinkage-free concrete (SFC), even in non-wet curing circumstances, by combining the usage of:

a) a polycarboxylate-based water-reducing additive that minimises cement and water consumption while boosting aggregate content;

b) a unique polycarboxylate (PA/SRA) with a shrinkage-reducing admixture (SRA) made from polyethylene glycol that can lower the surface tension of liquid water entering through the capillary pores.;

At 30 minutes after mixing, 5 concrete mixtures with w/c of 0.50 and slump levels of 170- 200 mm were produced.Firstly, there is a decrease in the volume of cement paste and a rise in the amount of aggregate because of the typical decreased water content generated by the polycarboxylate superplasticizer at a certain w/c. Both play a significant role in the decrease of drying shrinkage.

Secondly, the SRA set in the system of polyethylene glycol escapes as a result of the alkaline environment of the aqueous solution brought on by the hydration of the cement. This further reduces drying shrinkage, which is linked to a reduction in water's surface tension, and this lowers capillary pressure.

**Dhir et al., [4]**

This study presents the findings of several durability tests on self-curing concrete. Preliminary surface absorption, potential variation (PV) chloride dispersion, depth of carbonation, half-cell corrosion potential, and determination of freeze/thaw durability were the experiments that were conducted.

During the program, 3 mixes were used: one with simply OPC as a binder, 1 with a 40% GGBS cement substitution, and 1 with PFA as a 30% cement substitute. There were 2 dosages applied: 0.005M and 0.l00M.

## III. EXPERIMENTAL PROGRAMME

The following was the proposed framework of the experimental program:

A 120 cubes, cylinders, and prisms were cast using 4 distinct mixes such as A1, A2, B1, and B2) and various curing circumstances (indoor, traditional) with varying dosages of the self-curing ingredient PEG-6000 (0%, 0.5%, 1%, and 2%). To govern the properties of fresh concrete, the compaction factor test was performed on all mixtures. CS tests were conducted at 7 and 28 days after curing, and to examine the cubes' ability to retain water, they were weighed every 3 days starting from the casting date. The digital scale that is utilised has a 5 gm accuracy. A graph of strength versus the % of the self-curing agent and a graph of water retentivity versus the average weight loss throughout the number of curing days are both shown.

The highest self-curing agent dose in this inquiry is limited to 2%, and the smallest dosage is established in accordance with the literature accessible [2].

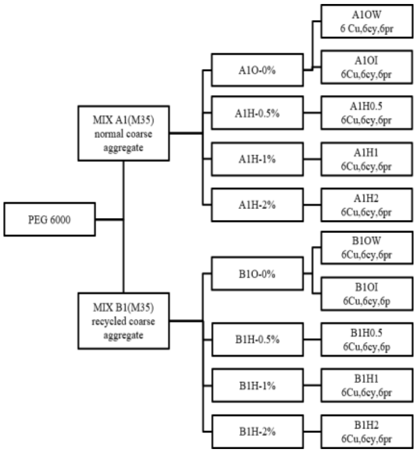
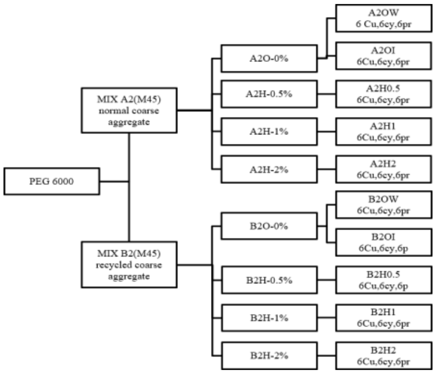


Fig:3.1.1FLOW CHART OF EXPERIMENTAL PROGRAMME FOR CONCRETE

**FIGURE 3.1.2 METHODOLOGY**



## SPECIMEN NOMENCLATURE

MIX A- standard coarse aggregate(A1-M35,A2- M45 grades) MIX B- recycled coarse aggregate (B1-M35,B2-M45 grades) OPC-Ordinary Portland cement

Higher Molecular Weight -PEG 6000

I- Inside curing

W-Wet/Conventional Curing

S C A-Self-Curing Agent

## 3.2) Materials Used

### Cement

The experiment employed 53-grade cement that complied with IS 12269-1987. Throughout the program, it was taken from a single batch and stored correctly. Table 3.2.1 provides a list of cement's physical characteristics.

Table 3.2.1 Physical properties of cement

| | |
|---|---|
| Initial setting time | 76 min |
| Final setting time | 218 min |
| Specific gravity | 3.13 |

### Fine Aggregate

Employed was fine aggregate that complies with IS 383-1970's Falls in zone-II. The neighbouring river course provided the fine aggregate that was used. Each sieve's sand retention was put into a different bag, which was then stacked separately for use and conformed as zone-II sand. Tables **3.2.2 respectively, indicate the physical characteristics of fine aggregate.**

Table 3.2.2Physical Properties of fine aggregate

| | |
|---|---|
| Specific gravity | 2.60 |
| Bulk density | 1.37gm/cc |
| Fineness modulus | 2.80 |

### Coarse Aggregate

The coarse aggregate of 12 to 20mm nominal size coarse material is used and satisfying the IS-383 guidlines. The quarry-purchased coarse aggregate was passed through each of the sieves up to 4.75mmAccording to tables 3.2.3, respectively, each fraction's physical characteristics.

| | |
|---|---|
| Specific gravity | 2.7 |
| Bulk density | 1.60gm/cc |
| Fineness modulus | 7.4 |

### Recycled coarse aggregate

The recycled coarse material utilised is 20 mm nominally sized and comes from a lab crushing plant. In this experiment, 20mm well-graded aggregate in accordance with IS-383 is used. All the upto 4.75 mm were used to separate the recycled coarse material that was purchased from the lab. According to Tables 3.2.4 each fraction' sphysical aracteristics displayed.

Table 3.2.4physical properties of recycled coarse aggregate

| | |
|---|---|
| Bulk density | 1327 kg/m3 |
| Fineness modulus | 7.38 |
| Specific gravity | 2.4 |

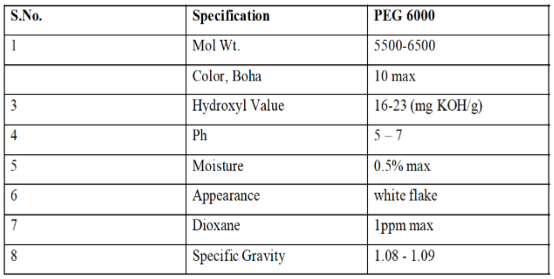
### Water

Injurious pollutants like alkalis, oil, acids, and other substances shouldn't be present in the water used to make concrete. Concrete was created and allowed to cure in the laboratory using regular drinkable water. It was determined that the water quality met IS: 456 -2000 standards.

**Polyethylene glycol (PEG)**

The standard formula for PEG is H (OCH2CH2)nOH, where n is the average number of repeated oxyethylene groups, commonly ranging from 4 to around 180. PEG is a condensation polymer of ethylene oxide and water.. The PEG is followed by a numerical suffix that describes the average molecular weights. PEG seems to have a common property called water soluble. Table 3.2.8 displays the PEG6000's specs. Additionally, it is soluble in a variety of organic solvents, including hydrocarbons that are aromatic (not aliphatic). Identical chemical and physical qualities are provided by the large variety of chain lengths for the right application selections indirectly or directly.

In a number of pharmaceuticals and drugs is used as a solvent, distributing agent, cosmetic and Supplied bases, carrier, and tablet excipient. It is odourless, lubricating, non-toxic, non-volatile, non-irritating and neutral. The PEG chemical structure is displayed below.



| S.No. | Specification | PEG 6000 |
|---|---|---|
| 1 | Mol Wt. | 5500-6500 |
|  | Color, Boha | 10 max |
| 3 | Hydroxyl Value | 16-23 (mg KOH/g) |
| 4 | Ph | 5 – 7 |
| 5 | Moisture | 0.5% max |
| 6 | Appearance | white flake |
| 7 | Dioxane | 1ppm max |
| 8 | Specific Gravity | 1.08 - 1.09 |

Table 3.2.8 Specifications of PEG 6000

## IV. RESULTS & DISCUSSION

### 4.1. STUDIES ON CONCRETE

### 4.1.1. COMPACTION FACTOR TEST

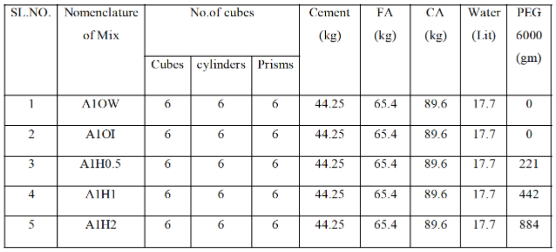
To determine workability and calculate the compaction factor, the compaction factor test is carried out. Table 4.1 presents the test findings. Figure 4.1 displays a plot of the compaction factor versus various PEG 6000 dosages. The observations from the Compaction Factor Test are listed below. It is evident from the specimens with PEG 6000 of Mix A that the 0.5% dosage of the SCA has a lower compaction factor than the 1% and 2% dosages. The compaction factor for specimens containing PEG 6000 of Mix B is higher as contrasted with the previous concentrations (1% and 2%). It is also evident that Mix B has a higher compaction factor than Mix A by 1% and 2%. Another observation is that Mix A's compaction factor increases as the percentage of PEG 6000 increases. But in Mix B, it goes from 0.5% to 1% before being reduced.

### 4.2 Water Retentivity Test

### 4.2.1. Mix A1 Water Retentivity Test

Weighing the samples with a digital scale with an accuracy of 5 gms for a period of 28 days at regular intervals allowed us to study concrete containing high molecular weight PEG that had been subjected to indoor curing. Table 4.2 has a record of the outcomes. Table 4.3 displays the analysis of the findings of the weight loss of each specimen. In fig.4.2, the weight decrease is displayed. The observations below pertain to concrete's water retentivity. It is evident that the 0% dosage of the SCA causes greater weight loss than the 0.5%, 1%, and 2% dosages. Additionally, it has been noted that the 2% dosage of the SCA results in less weight loss than the 0%,.5%, and 1% dosages.

Table 3.3.1 Materials Required for Mix A1



| SL.NO. | Nomenclature of Mix | No.of cubes |  |  | Cement (kg) | FA (kg) | CA (kg) | Water (Lit) | PEG 6000 (gm) |
|---|---|---|---|---|---|---|---|---|---|
|  |  | Cubes | cylinders | Prisms |  |  |  |  |  |
| 1 | A1OW | 6 | 6 | 6 | 44.25 | 65.4 | 89.6 | 17.7 | 0 |
| 2 | A1OI | 6 | 6 | 6 | 44.25 | 65.4 | 89.6 | 17.7 | 0 |
| 3 | A1H0.5 | 6 | 6 | 6 | 44.25 | 65.4 | 89.6 | 17.7 | 221 |
| 4 | A1H1 | 6 | 6 | 6 | 44.25 | 65.4 | 89.6 | 17.7 | 442 |
| 5 | A1H2 | 6 | 6 | 6 | 44.25 | 65.4 | 89.6 | 17.7 | 884 |

Table 3.3.2 Materials Required for Mix A2

| SL.NO. | Nomenclature of Mix | No.of cubes | | | Cement (kg) | FA (kg) | CA (kg) | Water (Lit) | PEG 6000 (gm) |
|---|---|---|---|---|---|---|---|---|---|
| | | cubes | cylinders | prisms | | | | | |
| 1 | A2OW | 6 | 6 | 6 | 49.6 | 53.2 | 93.1 | 17.8 | 0 |
| 2 | A2OI | 6 | 6 | 6 | 49.6 | 53.2 | 93.1 | 17.8 | 0 |
| 3 | A2H0.5 | 6 | 6 | 6 | 49.6 | 53.2 | 93.1 | 17.8 | 248 |
| 4 | A2H1 | 6 | 6 | 6 | 49.6 | 53.2 | 93.1 | 17.8 | 496 |
| 5 | A2H2 | 6 | 6 | 6 | 49.6 | 53.2 | 93.1 | 17.8 | 992 |

Table 3.3.3 Materials Required for Mix B1

| SL.NO. | Nomenclature of Mix | No.of cubes | | | Cement (kg) | FA (kg) | CA (kg) | Water (Lit) | PEG 6000 (gm) |
|---|---|---|---|---|---|---|---|---|---|
| | | Cubes | cylinders | prisms | | | | | |
| 1 | B1OW | 6 | 6 | 6 | 44.25 | 65.4 | 91.6 | 17.2 | 0 |
| 2 | B1OI | 6 | 6 | 6 | 44.25 | 65.4 | 91.6 | 17.2 | 0 |
| 3 | B1H0.5 | 6 | 6 | 6 | 44.25 | 65.4 | 91.6 | 17.2 | 221 |
| 4 | B1H1 | 6 | 6 | 6 | 44.25 | 65.4 | 91.6 | 17.2 | 442 |
| 5 | B1H2 | 6 | 6 | 6 | 44.25 | 65.4 | 91.6 | 17.2 | 884 |

TABLE 4.1 Compaction Factor for different percentages of PEG 6000

| Percentage Dosage of PEG | Compacting Factor | |
|---|---|---|
| | AH | BH |
| 0.5 | 0.98 | 0.934 |
| 1 | 0.988 | 0.976 |
| 2 | 0.996 | 0.956 |

Table 4.2Water Retentivity Test for Mix A1 for different percentages of PEG 6000

| Table 4.2.1 | Average weight of cubes at different ages(kg) | | | | | | |
|---|---|---|---|---|---|---|---|
| **DESIGNATION** | **0** | **3** | **7** | **10** | **14** | **20** | **28** |
| **A10W** | 8.502 | 8.485 | 8.497 | 8.50 | 8.517 | 8.52 | 8.5 |
| **A10I** | 8.433 | 8.436 | 8.427 | 8.450 | 8.445 | 8.400 | 8.399 |
| **A1H 0.5** | 8.665 | 8.693 | 8.600 | 8.628 | 8.59 | 8.56 | 8.54 |
| **A1H 1** | 8.559 | 8.558 | 8.541 | 8.560 | 8.55 | 8.54 | 8.53 |
| **A1H 2** | 8.599 | 8.558 | 8.562 | 8.593 | 8.572 | 8.56 | 8.52 |

| Table 4.2.2 | Avg weight of cylinders at different ages(kg) | | | | | | |
|---|---|---|---|---|---|---|---|
| **DESIGNATION** | **0** | **3** | **7** | **10** | **14** | **20** | **28** |
| **A10W** | 13.07 | 13.02 | 13.02 | 13.05 | 13.02 | 13.01 | 13.00 |
| **A10I** | 13.01 | 13.05 | 13.03 | 13.04 | 13.01 | 12.9 | 12.78 |
| **A1H 0.5** | 13.02 | 13.0 | 13.15 | 13.14 | 13.12 | 13.00 | 12.83 |
| **A1H 1** | 13.09 | 13.01 | 13.00 | 13.10 | 13.01 | 13.02 | 12.99 |
| **A1H 2** | 13.20 | 13.11 | 13.15 | 13.09 | 13.12 | 13.09 | 13.1 |

| Table 4.2.3 | Avg weight of prisms at different ages(kg) | | | | | | |
|---|---|---|---|---|---|---|---|
| **DESIGNATION** | **0** | **3** | **7** | **10** | **14** | **20** | **28** |
| **A10W** | 12.550 | 12.5 | 12.597 | 12.586 | 12.517 | 12.59 | 12.65 |
| **A10I** | 12.433 | 12.336 | 12.327 | 12.390 | 12.395 | 12.391 | 12.2 |
| **A1H 0.5** | 12.636 | 12.493 | 12.620 | 12.628 | 12.597 | 12.543 | 12.545 |
| **A1H 1** | 12.541 | 12.538 | 12.511 | 12.560 | 12.525 | 12.523 | 12.500 |
| **A1H 2** | 12.579 | 12.658 | 12.542 | 12.593 | 12.560 | 12.559 | 12.555 |

Tables 4.3Average Weight Loss for Mix A1 for different percentage of PEG 6000

Table 4.3.1Avg Weight Loss for Mix A1(cubes) for different percentage of PEG 6000

| Designation | Curing Period, Days | | | | | | | Weight loss Ratio |
|---|---|---|---|---|---|---|---|---|
| | 0 | 3 | 7 | 10 | 14 | 20 | 28 | |
| **A1OW** | 0 | -.022 | -0.025 | -0.33 | -0.034 | -0.036 | -0.037 | |
| **A1OI** | 0 | 0.058 | 0.057 | 0.067 | 0.069 | 0.077 | 0.080 | 1 |
| **A1H 0.5** | 0 | 0.019 | 0.024 | 0.027 | 0.029 | 0.035 | 0.035 | 0.75 |
| **A1H1** | 0 | 0.023 | 0.018 | 0.20 | 0.022 | 0.025 | 0.025 | 0.61 |
| **A1H2** | 0 | 0.018 | 0.019 | 0.020 | 0.024 | 0.024 | 0.025 | 0.52 |

Table 4.3.2Avg Weight Loss for Mix A1(cylinders) for different percentage of PEG 6000

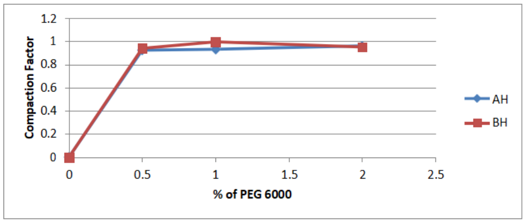


Fig 4.1 Compaction factor for different percentages of PEG 6000

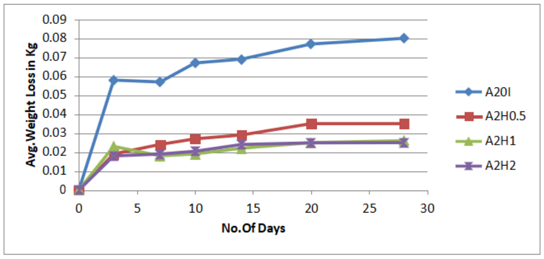


Fig:4.2.1.Avg Weight Loss for Mix A2 (CUBES) For the Different Dosages of PEG 6000

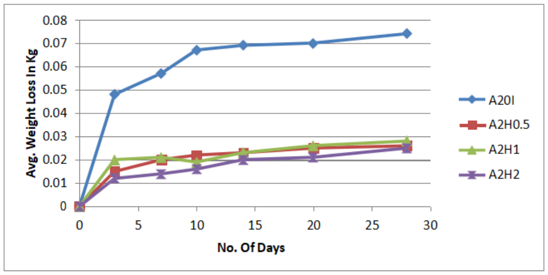


Fig:4.2.2 Avg Weight Loss for Mix A2 (CYLINDERS) For the Different Dosages of PEG 6000

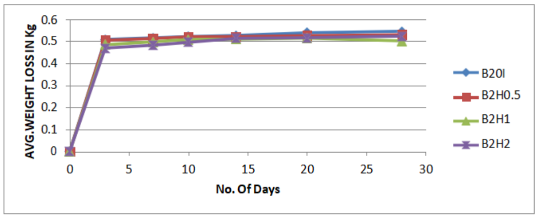


Fig 4.3.3AVG Weight loss for Mix A1 (prisms) for the different dosages of PEG6000

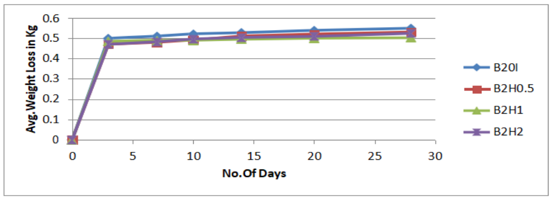
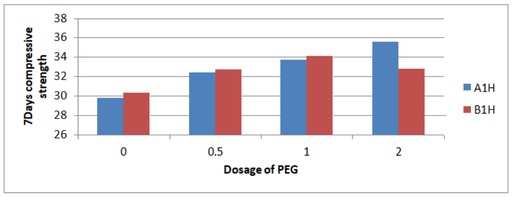
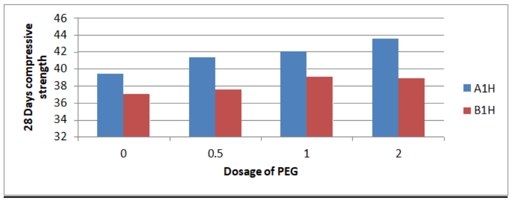


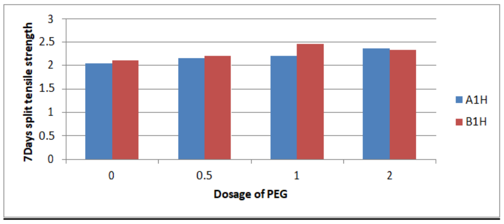
Fig: 4.4.1 Avg Weight Loss for MixB2 (CUBES) For the Different Dosages of PEG 6000



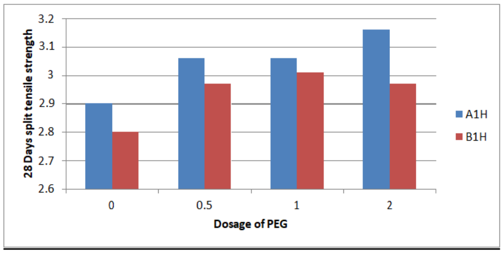
**4.10.1 Variation of 7 days compressive strength with different dosages of PEG6000**



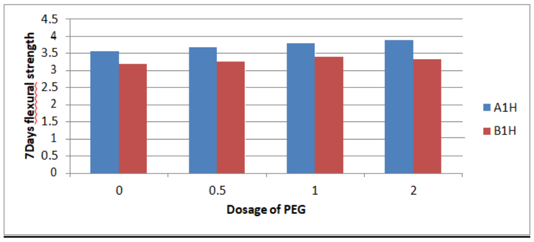
**4.10.2 Variation of 28 days compressive strength with different dosages of PEG6000**



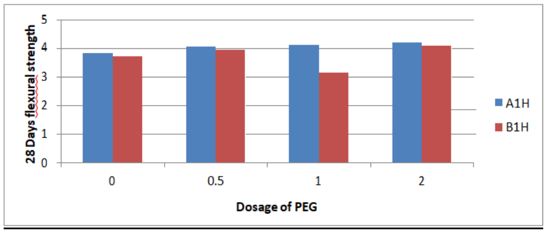
**4.10.3 Variation of 7 days split tensile strength with different dosages of PEG6000**



**4.10.4 Variation of 28 days split tensile strength with different dosages of PEG6000**



4.10.5 Variation of 7 days flexural strength with different dosages of PEG6000



4.10.1 Variation of 28 days flexural strength with different dosages of PEG6000

## V. CONCLUSIONS

The following conclusions on the SCA polyethylene glycol (PEG6000) and a comparison of various aggregates were drawn after the study of the experimental program's results.

### 7.1. Conclusions

a) Due to the use of PEG6000

- The higher molecular weight polyethylene glycol (PEG6000) has a significant influence on the workability of low w/c ratio concrete.

- The use of higher molecular weight polyethylene glycol (PEG6000) has a significant influence on the water retention of low w/c ratio concrete.

b) Conclusions from comparative studies of different coarse aggregate

- The w/c ratio and SCA percent dosages have an effect on the efficacy of SCC.
- SCA infused concrete mixtures retain more water than OC mixtures.
- If there is less weight loss, it is not required for the combination to have a higher CS.

c) Due to the use of Normal coarse aggregate

- PEG 6000 has made concrete more workable as compared to OC.
- The use of higher molecular weight polyethylene glycol (PEG6000) has a significant influence on the water retention of low w/c ratio concrete.

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