EFFECT OF STRENGTH OF SELF CURING CONCRETE USING POLYETHYLENE GLYCOL

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Abstract : *For constructions to become stronger, concrete is required. In order to attain strength, conventional concrete—a mixture of cement, fine aggregate, coarse aggregate, and water—needs to cure. Water is becoming a rare resource, thus it's critical to save it when creating concrete and building structures. One kind of contemporary concrete that cures itself is self-curing concrete, which does so by holding onto the moisture content (water).*

In order to improve the durability and performance of concrete, it is important to cure it. This project focuses on self-curring concrete using water-soluble polyethylene glycol as the self-curing agent. The present investigation involves the use of self-curing agent, namely, SAP, for dosages of 0%,0.5%,1%, and 1.5% by weight of cement added to the mixing water in the concrete. When compared to normal externally cured concrete mixes of about 5-20% for all the grades considered for study, there is a significant increase in the compressive, split-tensile, and flexural strength properties of self-curring concrete mixes at all ages of curing when compared to normal externally cured concrete mixes of about 5-20%. This improvement could be due to the continuous hydration process, leading to constant availability of water.

1. INTRODUCTION

1.1 General

Concrete buildings need to be properly cured in order to meet performance and durability standards. In conventional curing, this is achieved by doing external curing subsequent to mixing, placing, and finishing. Internal or self-curing curing is an additional moisture-supplying technique for better cement hydration and reduced self-desiccation in concrete. For a considerable amount of time to come, concrete will remain the most versatile material used in construction. Above all, whether it is manufactured on-site or as a pre-cast product in a factory, concrete has an edge over other building materials due to its unique ability to take any shape for a range of functions. Over the past 20 years, concrete technology has improved quickly.

Self-Curing Concrete can have agents added to it to create internally cured concrete. The concept behind internally cured agents is to increase the water retention capacity of the concrete by reducing water evaporation. Chemical admixtures aid in water retention by lowering the rate at which water evaporates from the surface of concrete. The following are shrinkage-reducing additives: polyvinyl alcohol, polyethylene glycol, and poly-acrylic acid. The standard formula for polyethylene glycol is H-(OCH2CH2) n-OH, where n is the average number of repeated oxy-ethylene groups, which normally ranges from 4 to 180. Polyethylene glycol is a condensation polymer of ethylene oxide and water. They are of the soluble kind in water. The following explanation applies to the self-curing mechanism: Because of the differences in the chemical potentials (free energy) of the liquid and vapour phases, moisture constantly evaporates from an exposed

The polymer lowers the chemical potential of the water molecules in the mixture by forming hydrogen bonds with them, which results in the retention of physical moisture.

As a result, water evaporation from the surface occurs more slowly. Water and ethanol are the only solvents in which polyethylene glycol is soluble; other organic solvents render it insoluble. It helps concrete hold onto water better. Research indicates that the strength increases at different PEG proportions; for M20 and M30 grades, for instance, 1% is appropriate, and for M40 grade, 0.5%.

1.1.1.Effect of Water Cement Ratio

a. Of all the factors influencing concrete's compressive strength, the w/c ratio is the most significant.

b. When it chemically reacts with the cement, it produces a gel that keeps the aggregate particles together.

c. The surface area of the aggregate to be wetted and the kind of compaction equipment available will determine the real amount of water a mix needs to give it adequate workability; this quantity surpasses the required for hydration.

d. It must allow the mixture to move in order to make placing and compacting concrete easier. For full hydration, 1g of cement needs, on average, 0.253g of water.

e. The property of the cement paste is enhanced, and as a result, its strength is reduced by the

1.1.2.Effect of Aggregate

A charge in the weight-to-cement ratio serves as an indirect link between aggregate and concrete's compressive strength. There are two ways in which aggregate directly affects strength: the aggregate's mechanical strength and its texture. The experimental findings show that the coarse aggregate size has an independent effect on the strength of the concrete, regardless of the weight-to-cement ratio. As the maximum size of the coarse aggregate increases, the strength diminishes.1.1.3. Effect of Specimen Size and Shape

Researchers discovered that as specimen size was decreased, the observed strength of prismatic and cylindrical specimens was higher but more variable, and that variability rose proportionately and quite dramatically as strength increased. Stress concentrations as potential drivers of failure will decrease as the specimen's length and cross section shrink.Methods of curing:

The type of job being done and the weather will determine which approach is adopted. The following techniques are typically used to cure concrete:rally was accepted:

1.3.2. Objective and Scope of study

This is a study in scope. The crucial step is to cure. Procedure Regarding the concrete construction, it needs to be watered under hospitable conditions for 28 days. This problem prompts development into a curing method that preserves compressive strength while requiring little to no water. Therefore, internally cured concrete—which is made possible by the use of self-curing chemicals like polyethylene glycol (PEG-4000)—can help solve the aforementioned difficulty. Therefore, the purpose of the work or research is to investigate the mechanical properties of concrete, such as compressive strength, using M30 grade concrete and altering the percentage of SAP from 0% to 2% by weight of cement. The goal is to investigate the mechanical properties of concrete, including its modulus of rupture, split tensile strength, and compressive strength, by adjusting the PEG percentage for M30 from 0% to 1.5% of the cement weight.

Admixture-cured internally cured concrete; SAP added to the concrete mix design;

M30 mix grade achieved; cubes, cylinders, and beams cast using mix design by adding 0%, 0.5%, 1%, 1.5%, and 2% of SAP separately; and, finally, strength was computed for each specimen.

2. LITERATURE REVIEW

[1] Roland Tak Yong Liang, Robert Keith Sun carried tend to the wax and glycol component of the concrete's internal curing. The invention makes an internal curing composition available for the first time. When mixed with concrete or other cementitious mixes, it meets Australian Standard AS 3799's curing requirements.

[2] Wen-Chen Jau asserted that the purpose of self-curing concrete is to draw water from the air and moisture in order to increase cement hydration. The difficulty is lessened when the degree of cement hydration is lowered due to no curing or inadequate curing by using poly-acrylic acid as a self-curing agent. Poly-acrylic acid has a strong capacity to absorb moisture from the atmosphere and give the water required for curing concrete.

[3] Patel Manish Kumar Dahyabhai, Prof. Jayesh Kumar Pitroda a study on "introducing the construction industry's use of self-curing concrete" To boost the compressive strength of self-curing concrete, self-curing admixtures are used. The addition of 1.0% PEG1500 and 3.7% PEG600 to the concrete mix produced a 37% and 33.9 increase in compressive strength, respectively, over standard concrete. It was found that 1% of the cement's weight was the optimal PEG600 dosage for maximal compressive strength in M25 grade concrete. The best PEG1500 dosage for M25 grade concrete was found to be 1% of the cement weight in order to produce the highest compressive strength. Self-curing concrete is the best way to address the problem of incorrect curing that occurs in the desert environment.

[4] Mohan raj Rajendran M researched "polyethylene glycol-incorporated self-curing concrete." Self-cured concrete has a higher compressive strength of cube by compression testing machine than concrete cured by sprinkler or full curing. The split tensile strength of self-cured cylinder specimen is higher than that of the conventionally cured specimen. Self-cured concrete is shown to have less water absorption values compared with concrete cured by conventional methods. Therefore, self-cured concrete has less porosity. The initial trials' success indicates the potential for further research. The mix design will be optimized for the self-curing agent in the concrete mix in planned studies.

[5] M. Manoj Kumar, D. Maruthachalam investigated self-healing. A highly absorbent polymer was the self-curing ingredient used. For the investigation, M40 concrete grade was utilized. These findings served as the basis for an experimental investigation. The subsequent subtraction was carried out. The progressive weight drop indicates a higher water retention rate in self-curing agent-infused concrete mixes when compared to conventional concrete mixes. A significant increase in mechanical strength is achieved with a SAP additive dosage of 0.3%. Concrete that was self-cured had a higher compressive strength than concrete that was water-cured when a 0.3% dosage was used.

Self-cured concrete has a higher split tensile strength than water-cured concrete when utilizing a 0.3% dosage. The flexural strength of self-cured concrete is less than that of water-cured concrete when utilizing a 0.3% dosage. The performance of the self-curing agent will depend on the mix proportions, namely the cement content and w/c ratio. The dosage was lowered after being progressively raised from 0.2% to 0.3%. Self-cured concrete with SAP was less expensive than traditionally cured concrete. In this investigation, cubes that were cured at room temperature (between 250 and 300 degrees Celsius) were cast. In warmer climates, the usefulness of self-cured members must be confirmed. Using internal curing concrete yields the best results SAP were obtained when 45 kg/m3 of water was added at a mean of 1 kg/m3 of SAP

[5] Mohammed Shafique Sanofar.P. B, Praveen., Jitin Raj, Nikhil, Gopi Krishna PEG600 was utilized as a self-curing agent in concrete. M20 and M25 grades of concrete are employed in the experiment. PEG600 was added to concrete of grades M20 and M25 at a weight percentage of 0-2%. They concluded that 1% of PEG600 by weight of cement was suitable to achieve maximum strength in M20 and M25 grade concrete. The Shikha Tyagi carried out research and explored the application of PEG400 as a self-curing agent in concrete. Our investigation will focus on concrete grades M25 and M40. She added 1% to 2% of PEG400 by weight to concrete of the M25 and M40 grades. For concrete grades M25 and M4O, a dosage of 1% and 0.5%, respectively, was found to

[6] Dayalan J had used super absorbent polymers as a self-curing agent in concrete. For M25 grade concrete, 0.0–0.48% of super absorbent polymer was added by weight of cement. He discovered that highly absorbent polymer, which makes up 0.48% of the cement weight, offers more tensile, flexural, and compressive strength than traditional mix.

[7] Siddiqui M. Junaidet. al. (2015) 1% and 1.25% of PEG-4000 by weight of cement) is used as a shrinkage-reducing admixture in M40 grade concrete (grade ratio = 1:2.23:3.08). This helps the concrete self-cure with better hydration, which reduces shrinkage cracks and increases strength. The strength of the concrete is compared to that of conventionally cured concrete of the same grade. Numerous studies have been conducted in the field of self-curing concrete; a selection of these studies is provided below. Researchers discovered that self-curing concrete works well as a substitute for regular concrete.

[8] Mousa M I et.al (2015) This study examines and compares the water retention and durability of concrete—with or without silica fume—as well as self-curing additives like leca and polyethylene-glycol. To assess the water retention of the tested concrete, measurements were made of the mass loss of the concrete and the volumetric absorption of water. All of the concrete's evaluated qualities have been greatly enhanced by the addition of 15% SF and self-curing chemicals. Specifically, 2% of polyethylene has been shown to produce the greatest outcomes and have strong durability qualities.

[9] Ole and Hansen elucidate a novel idea for preventing self-desiccation in cement-based hardening materials by incorporating fine, super absorbent polymer (SAP) particles into the concrete admixture. Water entrainment, or the creation of water-filled macro pore inclusions in the fresh concrete, is caused by the SAP's ability to absorb water and generate macro inclusions. As a result, self-desiccation is actively managed by the pore structure's design. This work describes and discusses water entrainment and self-desiccation.

[10] A.S. El-Diebgive an account of a novel idea that uses fine, super absorbent polymer (SAP) particles as a concrete admixture to prevent self-desiccation in cement-based hardening materials. The process by which the SAP absorbs water and creates macro inclusions causes water entrainment, or the creation of water-filled macro pore inclusions in the newly mixed concrete. As a result, the pore structure is purposefully created to prevent self-desiccation. Self-desiccation and water entrainment are explained and addressed in this article.

2.1 Research Significance

This study describes the development of self-curing concrete of grade M30 employing an optimal dosage of polyethylene glycol as an internal curing agent. When mineral admixtures fully react in a blended concrete system, either internal or external curing water is required. Nominal concrete constructions need a lot of water. Working locations with limited water availability experience early deformation and early aging cracking as a result of this natural phenomenon. This results in a decrease in moisture content, which also causes empty spaces to form in the cement gel and chemical shrinkage to occur during the hydration process. Therefore, self-curing is especially helpful when water is scarce.We utilize SAP as a self-curing agent in concrete to regulate the evaporation of water. If the chemical mix proportion was not appropriately mixed, early-age cracking and shrinkage may occur. With this self-curing technology, we got good results with large chemical mix.

Utilizing rebound hammer and ultrasonic pulse velocity tests, the workability, weight retention, compressive, split-tensile, and flexural strength characteristics of self-curing concrete mixes are assessed. Research is also conducted to estimate the quality and properties like structural integrity and compressive strength.

2. MATERIALS & PROPERTIES

3.0 General

The traditional concrete industry selects the materials used in Self-Curing Concrete (SCC). Cement, water, fine and coarse aggregates, and chemical admixtures (super-plasticizers) are the usual ingredients used in SCC. For SCC to become more widespread, a wide variety of common concreting materials must be able to be used in its design and construction.Materials

1. Cement
2. Aggregate
3. Water
4. Super plasticizer

Fig. 3.2. Compacting Concrete

3.3. Cement

Ordinary Portland cement (grade 53) from the local market was subjected to physical and chemical testing in compliance with IS:4031-1988. The results were in line with IS:12269-1987 and different standards.

3.4. Test on Cements

1. Normal consistency :30%
2. Initial setting time :35 min
3. Compressive strength @7 days :37N/mm^2
   28 days :53 N/mm^2
4. Specific gravity :3.01

Table 5.1 chemical composition of cement with ratios

Chemical composition	**Concentration**
Sio_2	21.06
Cao	57.98
Al_2O_3	6.10
Fe_2O_3	3.08

MgO	2.74
SO_3	2.40
Loss	4.07

3.5. Aggregates

3.5.i. Fine Aggregate

The natural sand from the local market is used in this investigation as the fine aggregate. The physical properties of fine aggregate that are measured in accordance with IS:383-1970 include specific gravity, bulk density, gradation, and fineness modulus.

Fig. 3.3. Fine aggregate

Table 5.2. Physical properties of Fine Aggregates

Property Result		**Bulk density (Kg/m3)**	
Fineness modulus	2.72	Loose	1585
Specific gravity	2.613	Compact	1690

3.5.ii. Coarse Aggregate

The current study uses crushed coarse aggregate with a maximum size of 20 mm that has been rounded, purchased from a nearby crushing factory called Robo silica in Hyderabad. According to IS-2386, tests are conducted on coarse aggregate to determine its physical characteristics, including specific gravity, bulk density, gradation, and fineness modulus.

Fig. 3.4. Coarse aggregate

Table 5.3 Physical properties of Coarse Aggregate

Property	**Result**
Fineness Modulus (FM)	7.10
Maximum size	20

Specific gravity	2.64
Bulk density(gm/cc)	1.42 - 1.61

3.6. Super Plasticizer

The concrete mix's super plasticizer prolongs its workability and requires significantly less water over an extended period of time.It has been noted that using a lot of finer material—fine aggregate, cement, and coarse aggregate—makes the concrete considerably stiffer and needs more water to be workable. hence, in the current study POLYETHYLENE GLYCOL(PEG-4000) is used as water reducing admixture.

Fig.3.5. Poly ethylene Glycol

4.2.1. Structure of Polyethylene-Glycol

The most effective way to identify the ideal dosage is to conduct site experiments using the concrete mix. This allows for the use of workability as a guide, with the rate of attention being within 2% of power value.

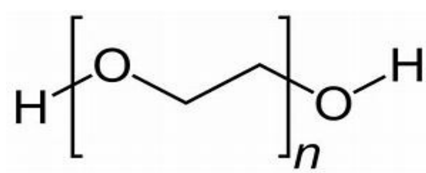


Fig.3.6. Poly ethylene Glycol structure

3.7. Water

This is the most crucial yet least expensive component of concrete. Water that is suitable for drinking should be used to make concrete; in general, the water used for this purpose should be pure and free of any dangerous pollutants like oil, alkali, acid, etc.

3.8. MIX DESIGN

Mix design is the process of choosing the best concrete materials and figuring out how to make concrete with a specific minimum strength and durability while staying within budget. The mix design for M30 grade concrete follows the BIS methodology.

3.15.1. STIPULATIONS FOR PROPORTIONING

For M30 mix design was done by Indian standard method.

a) Grade designation: M30

b) Type of cement : O.P.C. 53 grade confir to IS 8112

c) Maximum nominal size of aggregate : 20mm

d) Minimum cement content :320kg/m^3

e) Maximum water cement ratio : 0.45

f) Workability :100mm slump

g) Exposure condition : Severe (for R.C.)

h) Method of concrete placing : pumping

i) Degree of supervision : good

j) Type of aggregate : crushed angular agg.

k) Maximum cement content :450kg/m^3

l) Chemical admixture type : Super plasticizers

3.15.2. TEST DATA FOR MATERIALS

a) Cement used: O.P.C.- 53 grade confirm to IS: 8112

b) Specific gravity of cement :3.15

c) Chemical admixture: super plasticizerS

d) Specific gravity of

1) Coarse aggregate :2.74

2) Fine aggregate : 2.74

e) Water absorption

1) Coarse aggregate : 0.5 percent

2) Fine aggregate :1.0 percent

f) Free moisture

1) Coarse aggregate: nil

2) Fine aggregate: nil

3.15.3. Target strength for proportion of mix

Target mean strength for M30 grade concrete $f'_{ck} = f_{ck} + 1.65*S$

Where,
S = standard deviation degrees of control (good)=5.0 from table1
f'_{ck} = Target average compressive strength at 28 day
f_{ck} =characteristic compressive strength at 28 day $f'_{ck} = 30+1.65*5.0$
$= 38.25$ N/mm^2

Therefore, target strength =38.25N/mm^2

3.15.4. Selection of water-cement ratio

Max. water/cement = 0.45 (From table 5 of IS 456)

3.15.5. Selection of water

maximum water content for 20 mm aggregate= 186 litre

(for 25mm to 50 mm of slump) From table 2,

For 100 mm slump estimated water = 186+6/100*186 =197 litre

As super plasticizer is used, the water content can be reduced up to 15 percent and above. Based on trials with superplasticizer water content reduction of 15 percent has been achieved.

Hence, the arrived water content=197*0.85

=167.45 litre

3.15.6. CALCULATION OF CEMENT CONTENT

Cement content = 167.45/0.45 = 372.1 kg/m^3

From IS 456 - table 5, minimum cement content for 'severe exposure' condition

=320 kg/m^3 372.1kg/m^3>320kg/m^3,

hence ok

3.15.7. PROPORTION OF VOL. OF COARSE Agg. & FINE Agg.

Volume of fine aggregate (Zone II) and coarse aggregate (equivalent to 20 mm size aggregate) for the water-cement ratio of 0.50=0.62 is shown in Table 3.

The current ratio of cement to water is 0.45. As a result, in order to reduce the fine aggregate content, more coarse aggregate must be used. The volume of coarse aggregate is increased by 0.02 percent when the water-to-cement ratio is 0.10. Consequently, with the water-to-cement ratio of 0.45=0.63, the corrected fraction of coarse aggregate volume

Ten percent should be subtracted from these figures for pumpable concrete. Consequently, coarse aggregate volume =0.63*0.9=0.567

Vol. of fine-Agg. material content: 1-0.567 = 0.433

3.15.8. MIX CALCULATION

The mix calculations per unit volume of concrete shall be as follows

3.15.8.a. Normal concrete mix design

a) Vol. of concrete =1m^3

b) Vol. of cement =Mass of cement / Specific gravity of cement *1/1000

=437.7/3.15*1/1000 = 0.1389 m^3

c) Vol. of water = Mass of water / Specific gravity of water *1/1000

= 197/1*1/1000 = 0.197 m^3

d) Vol. of all in agg. =[a-(b+c)]

=1-(0.1389+0.197) =0.6641 m^3

e) Mass of coarse agg. = d*vol. of coarse agg. *sp. gravity of coarse agg.*1000

=0.6641*0.567*2.74*1000 =1031.73 kg

f) Mass of fine agg. =d*vol. of fine agg. *sp. gravity of fine Agg.*1000

=0.6641*0.433*2.74*1000 =787.901 kg

3.15.8.b. Mix proportions for trial number 1

1.Cement =437.7kg/m^3

2.Water =197 kg/m^3
3.Fine aggregate =787.901 kg/m^3
4.Coarse aggregate =1031.73 kg/m^3
5.Water cement ratio =0.45

3.16. MIX PROPORTION OF 0.5% of PEG

a) Vol. of content =1m^3

b) Vol. of cement =Mass of cement /S p. gravity of cement *1/1000
= 372.1/3.15*1/1000
= 0.118m^3

c) Vol. of water = Mass of water / Specific gravity of water *1/1000
= 167.45/1*1/1000 = 0.167 m^3

d) Vol. of chemical admixture = Mass of chemical admixture/specific gravity of admixture *1/1000
=1.575/1.128*1/1000 =0.0014m^3

e) Vol. of all in agg. = [a-(b+c+d)]
=1-(0.118+0.167+0.0014) = 0.7136m^3

f) Mass of c. agg. = e*vol. of coarse agg. *specific gravity of coarse agg.*1000
=0.7136*0.567*2.74*1000 =1108.63 kg

g) Mass of fine agg. = e*vol. of fine agg. *specific gravity of fine Agg.*1000
=0.7136*0.433*2.74*1000 =846.62 kg

3.16.1. Mix proportions for trial number 2

1.Cement = 372.1 kg/m^3

2. Water = 167.45kg/m^3

3. Fine aggregate = 846.62 kg/m^3

4.Coarse aggregate = 1108.63 kg/m^3

5.Chemical admixture =1.575 kg/m^3

6.Water cement ratio = 0.45

3.17. 1% of PEG MIX PROPORTION

a) Vol. of content =1m^3

b) Vol. of cement =Mass of cement / Sp. gravity of cement *1/1000
= 372.1/3.15*1/1000
= 0.118m^3

c) Vol. of water = Mass of water /nSpecific gravity of water *1/1000
= 167.45/1*1/1000
= 0.167 m^3

d) Vol. of chemical admixture = Mass of chemical admixture/sp. gravity

of admixture *1/1000
= 3.15/1.128*1/1000 = 0.002792 m^3

e) Vol. of all in agg. = [a-(b+c+d)]
=1-(0.118+0.167+0.002792) =0.7122m^3

f) Mass of coarse agg. = e*volume of coarse agg. *sp. gravity of c. agg.*1000
=0.7122*0.567*2.74*1000 =1106.45 kg

g) Mass of fine agg. = e*vol. of fine agg. *sp. gravity of fine agg.*1000
=0.7122*0.433*2.74*1000 =844.96 kg

3.17.1. Mix proportions for trial number 3

1.Cement = 372.1 kg/m^3

2.Water = 167.45kg/m^3

3.Fine aggregate = 844.96 kg/m^3

3.Coarse aggregate = 1106.45 kg/m^3

4.Chemical admixture =3.15 kg/m^3

4.Water cement ratio = 0.45

3.18. 1.5% of PEG MIX PROPORTION

a) Vol. of content =1m^3

b) Vol. of cement = Mass of cement /nSpecific gravity of cement *1/1000
= 372.1/3.15*1/1000 = 0.118m^3

c) Vol. of water = Mass of water/Sp. gravity of water *1/1000
= 167.45/1*1/1000 = 0.167 m^3

d) Vol. of chemical admixture = Mass of chemical admixture/sp. gravity of admixture *1/1000
=4.725/1.128*1/1000 =0.004188 m^3

e) Vol. of all in agg. = [a-(b+c+d)]
=1-(0.118+0.167+0.004188) =0.7108 m^3

f) Mass of coarse agg. =e*vol. of coarse agg. *sp. gravity of c. agg.*1000
=0.7108*0.567*2.74*1000 =1104.28 kg

g) Mass of fine agg. =e*volume of fine agg. *specific gravity of fine Agg.*1000
=0.7108*0.433*2.74*1000 =843.30 kg

3.18.1. Mix proportions for trial number 4

1.Cement = 372.1 kg/m^3

2.Water = 167.45kg/m^3

3.Fine aggregate = 843.30 kg/m^3

4.Coarse aggregate = 1104.28 kg/m^3
5.Chemical admixture =4.725 kg/m^3
6.Water cement ratio = 0.45

4. RESULTS AND DISCUSSION

4.1. Hardened Properties of SCC

According to the results, polyethylene glycol with a concentration of 0.51–1.5% can be successfully added to cement to create M30 grade concrete.

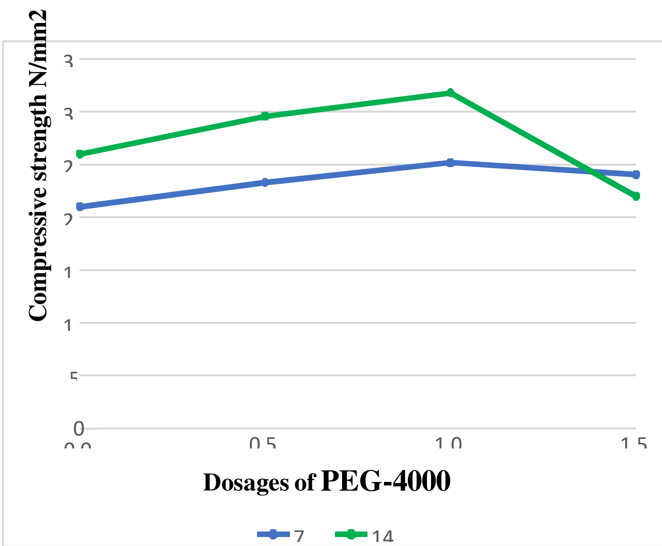
4.2. Compressive strength

It is determined from the expression given below.

Compression strength σb =P/A, in Mpa Where, P= Maximum applied load in KN
A= Area of mould

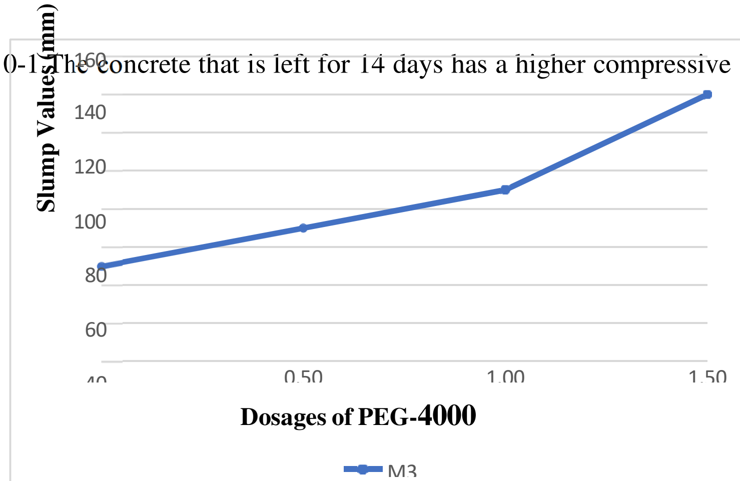
Fig. 4.1. Compressive strength testing machine

It has been found that adding 0.5% of PEG to the cement produces the best strength gains after 7, 14, and 28 days of curing, whereas adding 1.5% of PEG results in the lowest strength.



Graph 4.1 - Line chart of compressive strength of M30 concrete

We compared the compressive strength after seven and fourteen days in this graph. PEG-4000 doses are on the X-axis and compressive strength is on the Y-axis. At both 7 and 14 days after concrete placement, the compressive strength of the material is high, at 1.00% of PEG. The compressive strength also declines with an increase in PEG-4000 %, so it is preferable to add superplasticizer up to a maximum of 0-1 The concrete that is left for 14 days has a higher compressive strength than that of 7 days.

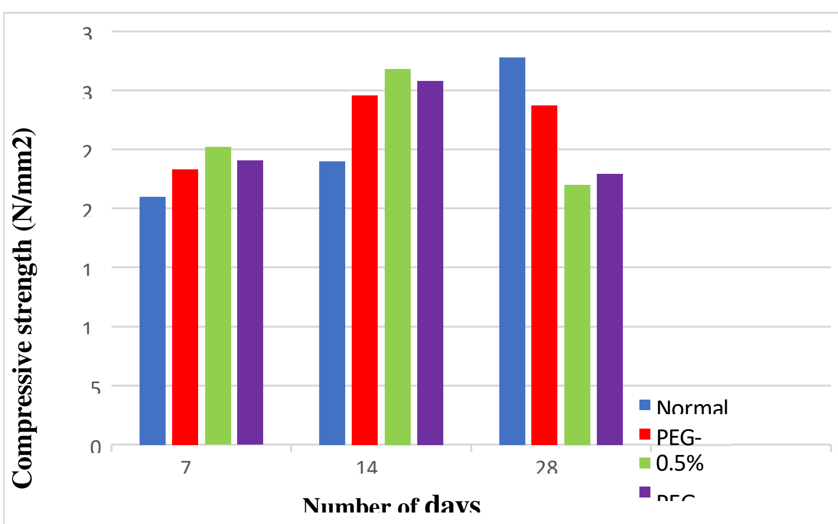


Graph 4.2 Slump Cone test result

The Y-axis in this graph represents slump values, and the X-axis represents PEG-4000 dosages. The least slump value is 0.5% of PEG, while the maximum is 1.50%.

Table 4.2 Results of Compressive strength using PEG-4000

Percentage of PEG-4000 by WT. of Cement	7Days "Mpa"		14Days "Mpa"		28Days "Mpa"	
	3Cubes	Avg. Value	3Cubes	Avg. Value	3Cubes	Avg. Value
0%	20.1	21	26.01	26	30	30.90
	21.0		25.9		32.7	
	22		26.3		30	
0.5%	23.6	23.3	30	29.6	28.3	28.7
	23.4		28.9		29.1	
	23		29.8		28.6	
1%	24.9	25.2	32	31.8	21.9	22.0
	25.3		31.4		22.05	
	25.5		31.9		22	
1.5%	24	24.0	22	22.0	22.9	22.9
	23.9		21.9		23.01	
	24.2		22.06		22.8	



Graph 4.3 Compressive strength at different ages of curing using PEG for M30 grade of concrete

In the bar graph, various percentages of polyethylene glycol added to concrete for seven, fourteen, and twenty-eight days are compared to self-curing concrete and regular concrete. The number of days is on the X-axis and the compressive strength is on the Y-axis. The compressive strength of regular concrete peaks after 28 days and troughs after 7 days of curing. The maximal compressive strength of self-curring concrete with 0.5% and 1.0% PEG is reached after 14 days of curing.

5. CONCLUSIONS

i. In the present examination, the various experiments were conducted to explore the characteristic behaviour and strength of self-curing concrete by applying the chemical additive.

ii. The optimal amount of dosage of PEG for compressive strength, split tensile strength and modulus of elasticity is determined for 1.5% for concrete of grade M30.

iii. Autogenous shrinkage can be effectively eliminated with self-curing concrete.The self-curing concrete gains up to 10% more compressive strength when PEG is added.

iv. The ideal percentage is 10% of PEG at cement weight because it yields the maximum strength.

v. By employing this self-curing concrete in the construction field, less water will be used.

vi. Membrane curing is more beneficial than water curing in situations where there is a severe water constraint.

vii. Self-curing concrete presents a viable substitute for traditional concrete in arid places where water constraint is a significant issue.

viii. Using PEG-4000 as a curing agent produces better curing at the microstructural level, which is superior to immersion curing in terms of strength and durability. As such, it is a better practice than using traditional methods.

ix. The strength of concrete decreases as SAP dosage increases.

x. Comparing self-cured concrete to conventional concrete, the former demonstrated superior hydration even in drying conditions.

xi. The self-curing agent was found to improve workability based on the results of the workability test.

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