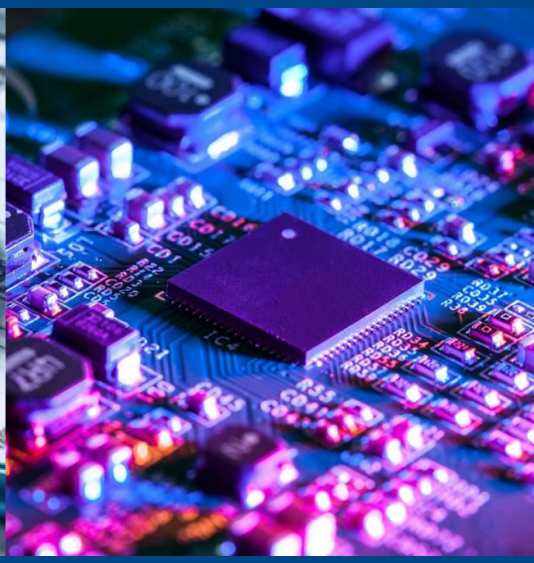
ISSN: 2582-7219





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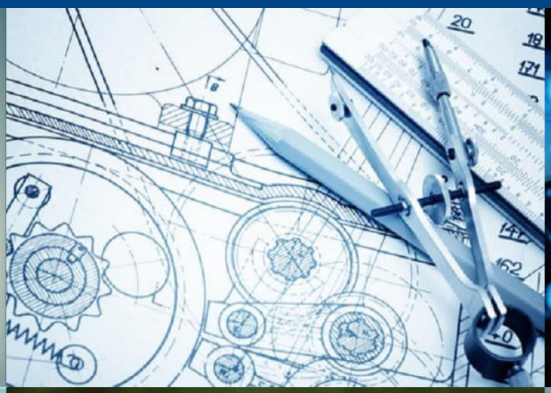

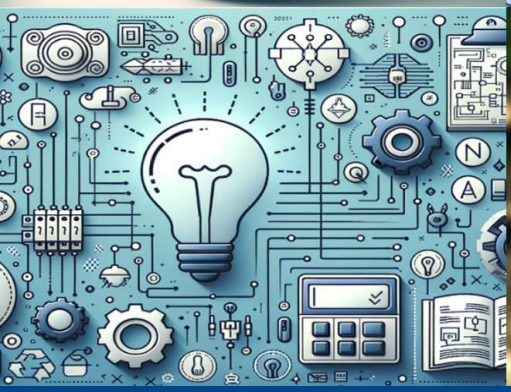

Impact Factor: 7.521

Volume 8, Issue 1, January 2025

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ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

A Comparative Study of Strength using Self Curing Concrete and Ordinary Concrete

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ABSTRACT: As we all know water is becoming a scarce material day by day and today the most used construction material is concrete due to its good strength and durability. So, there is a need to do research work for saving of water in making concrete and in construction as curing of concrete requires a large amount of water. The aim of this research is to study about the properties of concrete with or without using the selfeuring agent PEG 400 along with Chemical admixture named ShaliPlast PCE 300 as a Super plasticizer. The cement content of 307 Kg/m^3, super plasticizer by weight of cement, PEG of 0.5%,1.0%, 1.5%, 2.0% by weight of cement were selected in this study. The effect of these agents on the strength properties of concrete such as compressive strength, durability (UPV test) and flexural tensile strength was conducted and observed after 28days which was compared with those of the conventionally cued concrete. The test results were studied for grade M35 mix.

In this study it was found that PEG 400 help in self-curing by giving strength on par with that of the conventional curing method which shows internal self-curing is more effective and gives morestrength.

As per the result in the experiment conducted, the optimum dosage of PEG 400 for maximum strengths was found to be 1% for M35 grade of concrete as compare to conventional concrete.

Keywords:-Poly ethylene glycol (PEG); self-curing concrete (SCC); normal curing concrete (NCC); compressive strength; flexure test; UPV test.

I. INTRODUCTION

Background of the study

The days will come soon when all the construction industry will be switching over to an alternative curing system, not only to save water for the sustainable development of the environment but also to promote the indoor and outdoor construction activities even in remoteareas where there is water scarcity.

The process of controlling the rate and extends of moisture loss from concrete during cement hydration is known as Curing. It may be either after placing it in a position or during the manufacture of concrete products thereby providing time for hydration of the cement to occur.This procedure results in real with increased and diminished permeability.

Objective of the study

The objective of this study is to analytically investigate the characteristics of self- curingconcrete:-

- To compare the compressive strength of SCC and Ordinary Concrete.
- To study the analysis of flexural tensile strength of SCC and Ordinary Concrete.
- To examine the durability of SCC and Ordinary Concrete.
- Two concrete mixes of Ordinary Portland Cement (OPC) were considered for the study, PEG of molecular weight 400 was used as a self-curing agent in concrete. The concrete mix with and without self-curing agent (S.C.A) were subjected to different types of curing, .i.e., conventional and indoor curing to study the above mentioned parameters.
- To study the effect of self-curing concrete varying the percentage of PEG 400 from 0%, 0.5%, 1.0%, 1.5% and 2% by weight of cement for M35 grade of concrete.

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| ESTD Year: 2018|

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II. LITERATURE REVIEW

Desai et al. (2024): Conducted a meta-analysis of research from 2017–2024, confirming the superior performance of self-curing concrete (SCC) over ordinary concrete in terms of strength, durability, and sustainability. The study emphasized the role of advanced admixtures in enhancing SCC's applications.

Khan and Ahmed (2024): Explored bio-based self-curing agents. The results showed a 15% improvement in compressive strength and better environmental compatibility compared to synthetic agents.

Aggarwal et al. (2023): Analyzed the performance of SCC in high-rise buildings. The study highlighted that SCC improved workability and strength in structural elements exposed to varying environmental conditions.

Banerjee et al. (2023): Investigated the economic feasibility of SCC and concluded that advancements in admixture technology could make SCC a cost-effective alternative for large-scale projects.

Rajput and Verma (2022): Optimized the mix design for SCC, showing that it required 60% less water for curing while achieving compressive strength comparable to ordinary concrete.

Thomas and Fernandes (2022): Studied the sustainability of SCC using recycled aggregates. The research demonstrated that SCC with recycled materials achieved comparable strength and superior durability.

Self-curing concrete is a promising alternative to ordinary concrete, especially in water-scarce regions. Its ability to enhance strength, reduce water consumption, and improve durability makes it a sustainable choice for modern construction.

III. MATERIALS AND EXPERIMENTAL PROGRAM

Materials

In the experimental work, the material used for this study are as under:

- Ordinary Portland Cement (OPC)
- Coarse aggregates
- Fine aggregates
- Water
- Polyethylene Glycol
- Super plasticizer

Table 1 Parameters of Coarse aggregates 10mm & 20mm

Parameters	Coarse Aggregates	
	10mm	20mm
Specific Gravity	2.65	2.64
Impact Value (%)	18	19
Water Absorption (%)	0.67	0.78
Free Moisture Surface (%)	Nil	Nil

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Poly Ethylene Glycol:-

Polyethylene glycol (PEG), also known as Polyethylene oxide (PEO) or Polyoxyethylene (POE), is the most commercially important polyether used as self-curing agents. PEG, PEO or POE refers to an oligomer or polymer of ethylene oxide. Polyethylene glycol is a condensation polymer of ethylene oxide and water with general formula H(OCH2CH2)nOH, where n is the average number of repeating or ethylene groups typically from 4 to 180.

Table 2: Properties of PEG 400

roperties	**Values**
IUPAC Name	Polyethylene Glycol
Chemical Formula	$C_{2n}H_{4n+2}O_{n+1}$; n= 8.2 to 9.1
Molar mass	380 – 420 g/mol
Density	1.128 g/cm^3
Melting point	4 to 8ºC
Viscosity	-
Flash point	2398ºC

Concrete Mix Design

Concrete mix design is the process of finding right proportions of cement, sand and aggregates forconcrete to achieve target strength in structure. So, concrete mix design can be stated as, Concretemix = Cement : Sand : Aggregates.

Table 3 Mix proportions of NCC and SCC(final mix)

Properties	**Percentage of PEG-400 (Grade M35)**				
	0%	**0.5%**	**1.0%**	**1.5%**	**2.0%**
Cement(Kg/m^3)	316.05	316.05	316.05	316.05	316.05
Water (Kg/m^3)	142.22	142.22	142.22	142.22	142.22
Fine aggregates (Kg/m^3)	826.278	824.672	823.077	821.466	819.862
Coarse aggregates (Kg/m^3)	1081.98	1079.88	1077.79	1075.684	1073.583
Water cement ratio	0.45	0.45	0.45	0.45	0.45
PEG-400(Kg)	0	1.58	3.16	4.74	6.32

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IV. RESULTS AND DISCUSSION

Compressive Strength Test Result

Compression testing machine is capacity 2000KN used to conduct the test. The specimen was placed between the steel plate of CTM and load was applied at the rate of 140Kg/Cm2/min and the failure load in KN was observed from the load of the CTM.

Average compressive strength of the concrete cube = 42.3 N/mm^2

Compressive strength of concrete at various ages:

The strength of concrete increases with age.

The table shows the strength of concrete at different ages in comparison with the strength at 28days after casting.

Table 4: Compressive strength of different grades of concrete at 7 days and 28 days

Grade ofconcrete	Minimum compressive strengthN/mm^2 at 7 days	Specified characteristicscompressive strength (N/mm^2) at 28 days
M15	10	15
M20	13.5	20
M25	17	25
M30	20	30
M35	23.5	35
M40	27	40
M45	30	45

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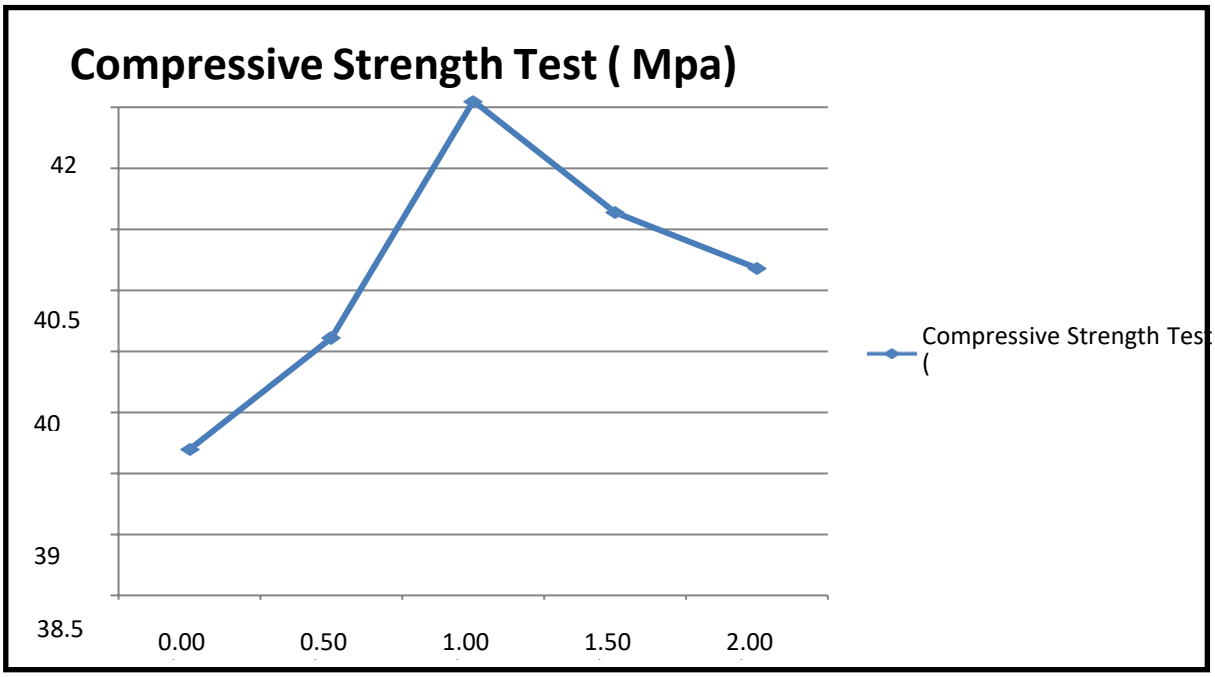

Fig. 1: Compressive strength graph between different % of PEG

Table 5: UPV at different percentage of PEG

S.No.	Test location identification	Method of probing (d/I/S)	Time Duration (micro seconds)	Distance betweenProbes (mm)	UP Velocity(m/sec)	Inference (Concrete Quality Grading)
1.	0.0 %	Direct	38.5	150	3.90	Good
2.	0.5 %	Direct	31.7	150	4.73	Excellent
3.	1.0 %	Direct	30.9	150	4.85	Excellent
4.	1.5 %	Direct	31.5	150	4.76	Excellent
5.	2.0 %	Direct	36.6	150	4.10	Good

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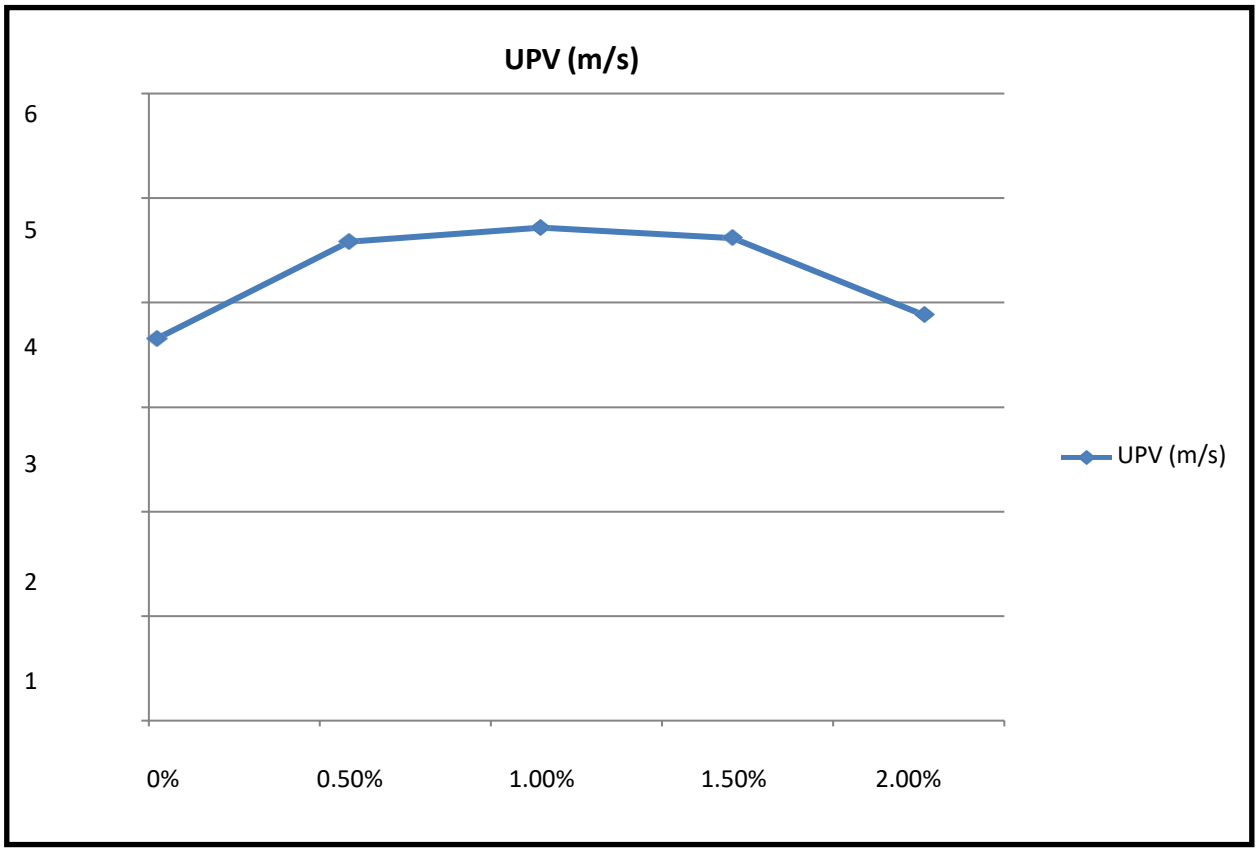

Fig. 2 : Graph between UP Velocity (m/sec) and different % of PEG – 400

Table 6 : Flexural strength result at different % variations of PEG 400

Flexural Strength		
Beam IdentificationNo.	**Variation**	**Flexural Strength(N/mm2)**
1.	0.0 %	4.52
2.	0.5 %	4.56
3.	1.0 %	4.65
4.	1.5 %	4.60
5.	2.0 %	4.58

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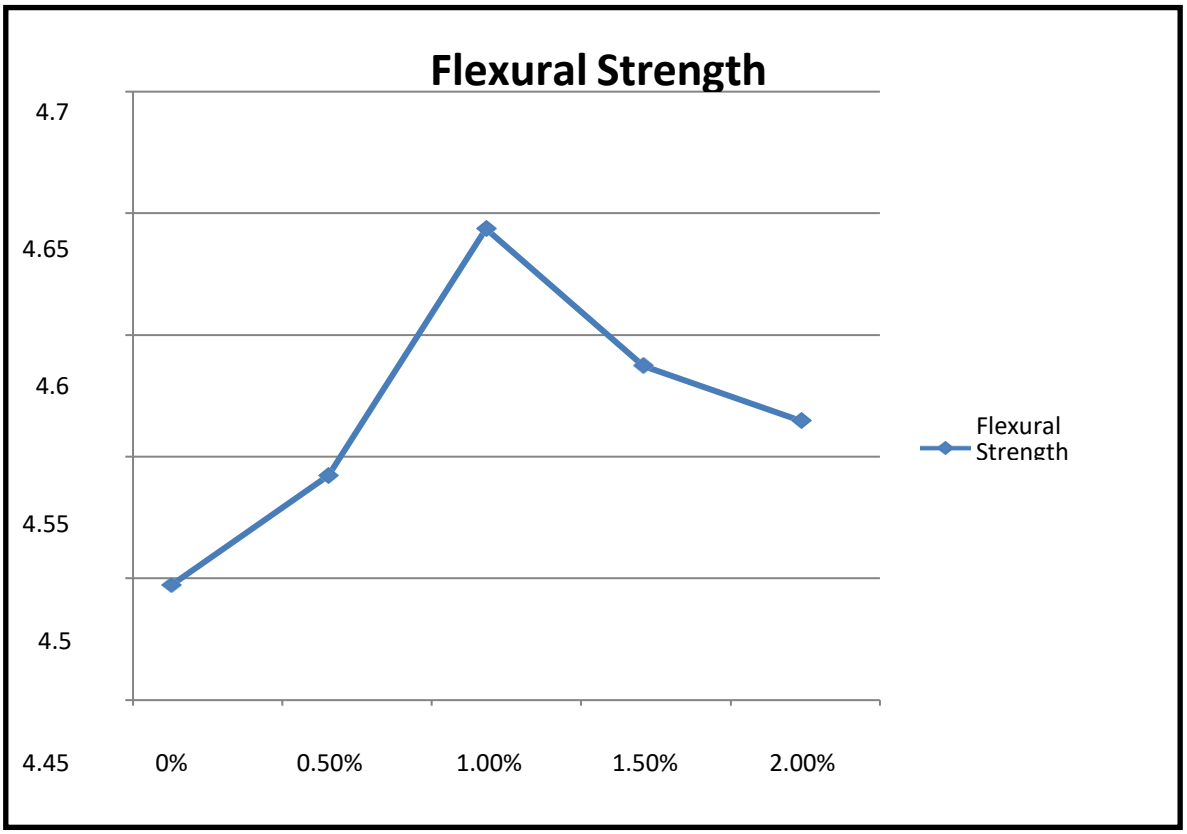

Fig. 3: Graph showing flexural strength between different % of PEG

V. CONCLUSION

- As per the result compiled in the figure the optimum dosage of PEG 400 for maximum strengths was found to be 1 % for M35 grade of concrete as compare to conventional concrete.
- Compressive strength of Self Curing Concrete increases with the increase in percentageof PEG 400 up to 1.0% and then decreases.
- Ultra-Sonic Pulse Velocity of Self Cured Concrete increases with the increase in percentageof PEG 400 up to 1.0% and then decreases.
- Flexural tensile strength of Self Cured Concrete increases with the increase in percentageof PEG 400 up to 1.0% and then decreases.
- Self – curing concrete is the answer to many problems faced due to lack of proper curing and can be effectively used where there is scarcity of water and inaccessible difficult terrains.
- For OPC mix, the compressive strength, UPV test and flexural strength of Self curing concrete are greater than Conventional curing concrete.

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