



Comparative Study between Polyethylene Glycol-400(PEG) & Polyvinyl Alcohol for Self Curing Concrete

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ABSTRACT:

The main objective of project is the comparative study between the both self curing agents by varying dosages of both for the improvement of compressive strength. The study focused on the properties of self-curing concrete using Polyethylene Glycol (PEG400) as a self-curing agent.

The main goal was to determine the optimal percentage of PEG400 that enhances the concrete's strength while also examining its effects on workability characteristics such as slump and compaction factor. Various percentages ranging from 0% to 1.5% by weight of cement were tested. Compressive strength and slump cone test was conducted for the same.

Increasing the percentage of PEG400 led to improvements in the slump and compaction factor, indicating enhanced workability. Increasing the percentage of PEG400 led to improvements in the slump and compressive strength and thus indicating enhanced workability.

The aim was to determine the optimal percentage of PVA that enhances the concrete's compressive strength compared to a conventional concrete mix. [11:27 AM, 5/30/2024] PVA Tested at 0.8% and 1% by weight of cement. The incorporation of 1% Poly Vinyl Alcohol by weight of cement in concrete leads to enhanced compressive strength making it superior to conventional concrete mixes in terms of these key strength parameters. As the self curing agents were applicable by the method of internal curing the shells of gel formation was noticed which keeps the concrete hydrating throughout the curing time of 28 days

INTRODUCTION:

Curing of concrete plays a major role in developing the concrete microstructure. According to the ACI 308R, Guide to Curing Concrete, "the term 'curing' is frequently used to describe the process by which hydraulic cement concrete matures and develops hardened properties over time as a result of the continued hydration of the cement in the presence of sufficient water and heat". Thus, the role of curing practice lies in reducing water evaporation from concrete to maintain satisfactory moisture content inside concrete which is essential for the continuation of hydration of the cement, and consequently the development of concrete microstructure, pore structure, and needed properties. Proper curing is vital for structures to meet their designed life and minimize maintenance cost. However, good curing is not always practical in many cases. Several studies concluded that increasing the water retention in the mixture can act as internal curing. Several researchers introduced the concept of self-curing concrete. Self-curing concrete can be produced by incorporating self-curing agents in the concrete mixture.

The self-curing agents were mainly chemicals that can absorb and retain water inside the concrete mixture which will reduce water evaporation from the concrete mixture. As the cement hydration proceeds and the internal relative humidity decreases, the self-curing agent will release the absorbed water as an internal water curing source. Hydrophilic water-soluble polymers were successful as self-curing agents. Hence the use of self-curing concretes would be of great benefit in areas where water is not adequately available and will shift the concrete construction to a new level of sustainability.

Material testing :

- Test on cement:
- Finess of cement
- Test on coarse and fine aggregate:
- Sieve analysis
- Concrete cube testing:
- Compressive strength after 28 days

Slump Cone test:

- To check the workability of concrete.
- To check the appropriate w/c ratio
- To know the slump value of concrete.

Properties of PEG & PVA

Molecular weight -400 g/mole

Apperance -Clear liquid

Melting point -4-8 degree

Solubility in water-soluble

Specific gravity-1.12 PH >6

PEG is a low molecular weight solvent use-full for substances which do not readily dissolve in water. PEGs a type of condensation polymer composed of ethylene oxide and water, where n refers to the average number of repeating oxy-ethylene groupsPolyethylene 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.

METHODOLGY:

Cube casting for compressive strength results by addition of Peg-400 with 1% & 1.5% by weight of cement & PVA with the 0.8% & 1% by weight of cement

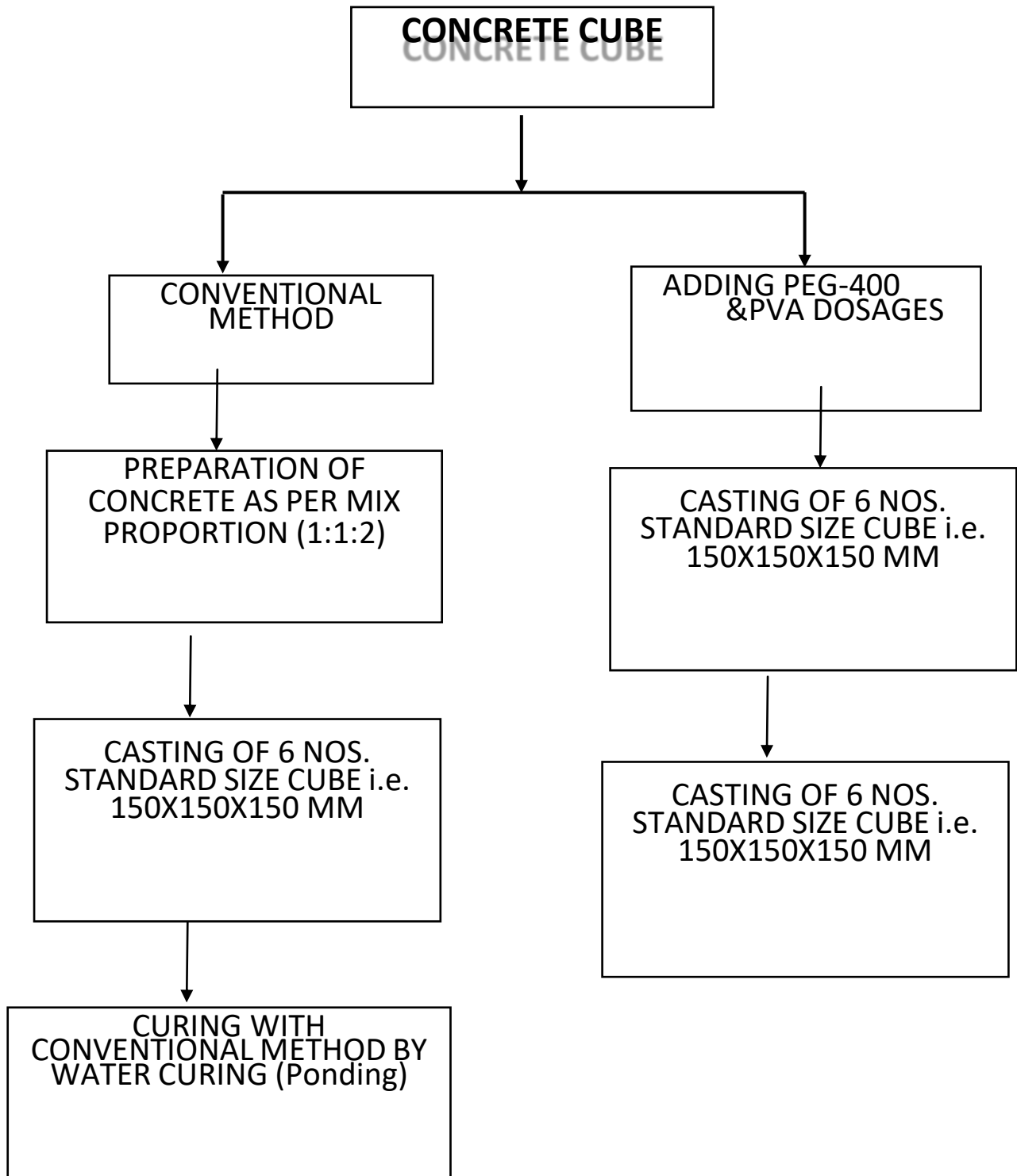


Precautions to be taken while casting and curing.

- Proper Mixing
- Temperature Control
- Avoid Overwatering

- Protection from Elements
- Minimize Disturbance
- Monitoring Hydration
- Use of Admixtures
- Avoid Segregation and bleeding

Mix design steps for traditional concrete and concrete cubes with PEG-400 and PVA with various dosage.



Results of PEG-400 For dosage of 1.5% by weight of cement.

Days	Cubes	Normal concrete curing	PEG-400
7	Specimen -1	15	16.0
	Specimen -2	15	15.9
	Specimen -3	15	16.3
			16.06
28	Specimen -1	25	26.4
	Specimen -2	25	25.8
	Specimen -3	25	26.2
			26.2

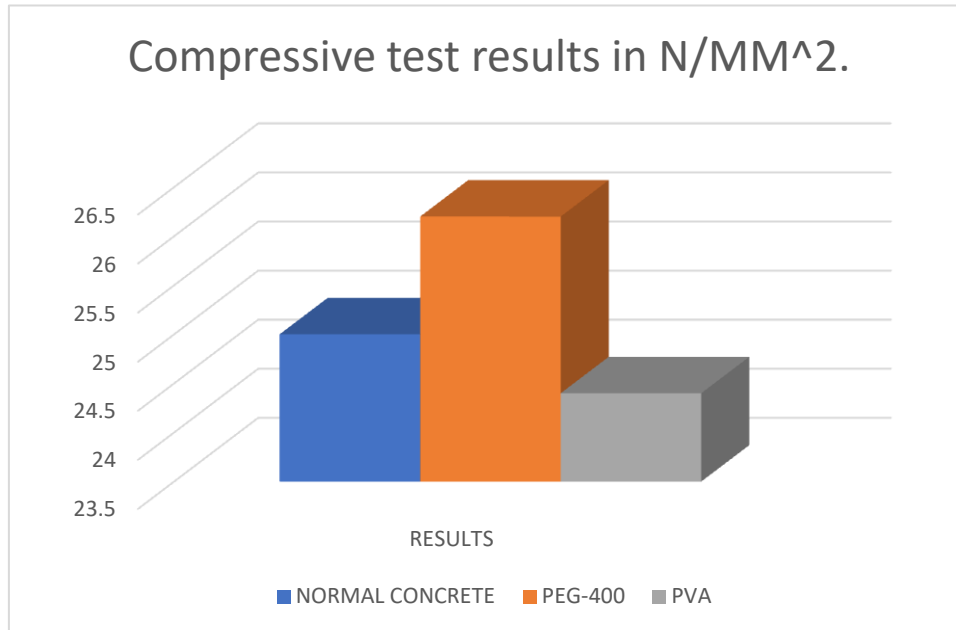
Results of PVA For dosage of 1 % by weight of cement.

Days	Cubes	Normal concrete curing	PEG-400
7	Specimen -1	15	15.0
	Specimen -2	15	14.8
	Specimen -3	15	14.9
			14.9
28	Specimen -1	25	24.2
	Specimen -2	25	24.7
	Specimen -3	25	24.5
			24.4

LIMITATIONS

- Variation in temperature from 41°C to 24°C during the experimental study resulted in variation of strength results than that was expected.
- As the percentage of PEG increased, mix showed tendency of bleeding and in case of PVA the increase in percentage resulted in stiff Mixture.

Final Comparison of results of conventional, PEG-400, PVA



Conclusion

1.The self-curing material has a greater hydrating effect than traditional concrete under drying conditions. It is observed that when the quantity of poly ethylene glycol (PEG) increases the slump value rises.i.e it improves the workability of concrete.

2.In the desert regions, this method of curing is adopted.
When PVA % increases , it results in reduction of weight loss.

3.Water retention for the concrete mixes incorporating self curing agent is higher when compared to conventional concrete mixes, as found by the weight and time.When compared to conventional concrete, SCC resulted in better hydration with time under drying condition.

4.Cement Content and W/C Ratio affects the performance of the self curing agent.

5.Self-curing concrete is more effectual of reducing autogenous shrinkage.

For Peg-400, The dosage was as follows:-

1% & 1.5% by weight of cement. So the 1.5% dosage results were effective as compared to 1 %.

0.8 % , 1 % dosage of PVA in powder form by weight of cement . Use of Polyvinylalcohol (1 % by the weight of cement) as self curing agent Provides higher compressive strength.

PVA is economical as compared to peg-400

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