

## “AN EXPERIMENTAL INVESTIGATION OF SELF CURING CONCRETE INCORPORATED WITH POLYETHYLENE GLYCOL AS SELF CURING AGENT”

**Shikha Tyagi**

*M.Tech (Structure Engineering & Construction) Student, Roorkee Institute of Technology, (UTTRAKHAND)*

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**Abstract:** Concrete is most widely used construction materials due to its strength, permanence and durability. Since the concrete is open to atmosphere, the water used in concrete evaporates and the water available in concrete will not be sufficient for effective hydration. If the hydration is to continue unabated, extra water must be added to replenish the loss of water on account of absorption and evaporation. Alternatively, some measures must be taken to prevent the loss of water from the surface of concrete. Therefore, the curing can be considered as creation of a favourable environment during the early period for uninterrupted hydration. The present study involves the use of shrinkage reducing admixtures like POLYETHYLENE GLYCOL (PEG 400) as internal curing compound. This curing compound used in concrete which helps in self curing and helps in better hydration and hence good compressive strength. They trap the moisture within the structure and prevent it from evaporation which normally occurs due to the hydration process.

In the present study, the affect of curing compound on workability (slump and compaction factor) and compressive strength is studied. In this study the percentage of PEG by weight of cement from 0% to 2% as the dosage of internal curing compound was fixed. The test results were studied both for M25 and M40 mixes. It is found through this experiment study that PEG 400 help in self curing by giving strength on par with that of the conventional curing method and also improved workability.

**Keywords :** Self curing, replenish, hydration, conventional curing, retention.

### 1. INTRODUCTION

Concrete is the basic engineering material used in most of the civil engineering structures. Its popularity as basic building material in construction is because of its economy of use, good durability and ease with which it can be manufactured at site. Concrete like other engineering materials needs to be designed for properties like strength, durability, workability. With advent of new generation admixtures, it is possible to achieve higher grades of concrete with high workability levels economically. Curing is the maintaining of a satisfactory moisture content and temperature in concrete during its early stages so that desired properties (of concrete) may develop.

The concept of self-curing agents is to reduce the water evaporation from concrete, and hence increase the water retention capacity of the concrete compared to conventional concrete. It was found that water soluble polymers can be used as self-curing agents in concrete.

### 2. EXPERIMENTAL STUDY

#### 2.1 Materials:-

A. Cement

- OPC (53 grade) conforming to IS:12269-1987

B. Fine aggregate conforming to IS: 383-1970

Table 1. Final result on test of fine Aggregate

S. No.	Particulars	Fine Aggregates
1.	Source	Crusher
2.	Zone	Zone III
3.	Specific Gravity	2.6
4.	Water Absorption	3%

C. Coarse Aggregate conforming to IS: 383-1970

Table 2. Final result on tests of coarse aggregate

Sr. NO	Particulars	Coarse Aggregates
1.	Source	Crusher
2.	Max. Aggregate size	20mm
3.	Specific Gravity	2.7
4.	Water Absorption (%)	0.5%

D. Water

- Potable water was used in the experimental work for both mixing and curing purposes.

E. Polyethylene Glycol-400(PEG-400) (Used as an internal curing compound):-

Polyethylene 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 polyethylene groups typically from 4 to about 180. One common feature of PEG appears to be the water-soluble nature. Polyethylene glycol is non-toxic, odorless, neutral, lubricating, non-volatile and non-irritating and is used in a variety of pharmaceuticals. Thus, it is a shrinkage reducing admixture.

**2.2 Scope of Research**

To study the strength properties of concrete made with curing compound i.e. polyethylene glycol as self curing agent with that of concrete made from conventional curing.

**2.3 Objective of study**

- To study the effect of different curing compound (PEG400) on the strength properties of concrete
- Concrete mixes are prepared based on different % of (PEG400)
- Conventional curing method (ponding)

**2.4 Research Methodology**

The systematic approach to study the gaps identified in the literature survey will be followed. Step by step methodology of the proposed work is as follows.

•Two grades of concrete has been selected for the research work M25 and M40

Mix design of concrete to be done as per IS: 10262-2009

•Testing of ingredients of concrete mix are carried out.

**WORKABILITY TEST:-**

**RESULTS & DISCUSSION**

**Slump and compaction factor test:**

The results of the slump & compaction factor test were represented in Table 1. As the %of PEG400 is increased the slump and compaction factor is found to increase. But, the rate of increase of slump & compaction factor for M40 concrete is less than that of M25 concrete.

TABLE 3: Result Of Workability for different % of PEG-400

SNO	PEG 400 (%)	SLUMP (mm)		COMPACTION FACTOR	
		M25	M40	M25	M40
1	0	65	48	0.87	0.85
2	0.50	79	65	0.88	0.87
3	1.00	97	95	0.90	0.90
4	1.50	120	130	0.91	0.91
5	2.00	160	160	0.94	0.94

**COMPRESSIVE STRENGTH:**

**Test result for various mixes:**

Average Compressive strength for 7 and 28 days obtained by taking average of 3 specimens for each day are compiled below.

**Table 4. Comparative Strength test results of various mixes for M25 Grade of Concrete**

MIX	AVERAGE COMPRESSIVE STRENGTH(N/mm <sup>2</sup> )	
	7 days	28 days
CONVENTIONAL CURING	23.26	32.26
PEG 400 0.5%	18.6	28.82
1%	21.49	38.85
1.5%	22.36	31.45
2%	21.49	30.43

Concrete made from curing compounds doesn't fall short of the minimum strength requirement i.e. 25 MPa. The strength achieved from curing compounds is much above 25MPa.

**Table5. Comparative Strength test results of various mixes for M40 grade of concrete**

MIX	AVERAGE COMPRESSIVE STRENGTH(N/mm <sup>2</sup> )	
	7 days	28 days
CONVENTIONAL CURING	36.29	46.65
PEG 400 0.5%	34.75	47.45
1%	38.45	44.69
1.5%	37.74	43.48
2%	36.22	41.67

Concrete made from curing compounds doesn't fall short of the minimum strength requirement i.e. 40MPaThe strength achieved from curing compounds is muchabove40MPa.

### 3.CONCLUSION AND RECOMENDATIONS

#### 3.1 Conclusion

**On the basis of Experimental tests results and observations, following conclusions are made:**

1. As per the results compiled in tables 4& 5,compressive strength of various mixes for M25 and M40 Grade of concrete we conclude that the compressive strength of mixes using self curing compounds (PEG-400) are at par with that of the concrete with conventional curing.
2. The optimum dosage of PEG400 for maximum strength was found to be 1% for M25 and 0.5%for M40 grade.
3. As percentage of PEG400 increased slump increased forM25 and M40grades of concrete.
4. From the workability test results , it was found that the self-curing agent improved workability
5. It can be seen that the minimum strength as per the codal provisions has been achieved by the specimens cured through curing compounds. The strength achieved by the PEG400 is comparable for both types of mix i.e. M25 and M40.

#### 3.2 RECOMMENDATIONS FOR FUTURE SCOPE OF WORK

A lot more work needs to be done before we can freely use self curing compounds as a replacement to conventional curing techniques. Since the strength results are as good as compared to that achieved by conventional curing method but it needs additional research work to improve its quality and will certainly help to promote the usage of self curing compounds in concrete.

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