

Experimental Study on M20 Grade of Concrete by Using Self Curing Agent

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Abstract : Self-curing concrete is used to complete the use of water and promotes the hydration of curing cement. self curing may be a process that promotes the retention of water in concrete and also the release of water .evaporation is also done in this paper using PEG 400 and PVA as its agents. Polyethylene glycol (PEG 400) of relative molecular weight 400 (PEG 400) for dosages ranging between 0.5 %,1 % ,1.5 % by weight of cement and polyvinyl alcoholat for ranging between 0.5 %, 1 %, 1.5 % by mixing to water. Two mixes with w/c ratio were considered within the investigation workability test i.e. slump flow for M20 grade of concrete were conducted on the fresh concrete whereas compressive strength were evaluated to see the properties of hardened concrete.

Index Terms - Polyethylene Glycol 400 , Polyvinyl Alcoholat , M20 Grade , Workability, Compressive Strength.

I. INTRODUCTION

Concrete is widely used material in construction industry having high compressive strength. But has some deficiencies like shrinkage, cracking, low tensile, flexural strength and high brittleness that restricts its application. A trial is created overcome such deficiencies using Self curing agent PEG400 & PVA. Conventional concrete, Which is that the mixture of cement, fine aggregate, coarse aggregate and water needs curing to achieve required strength. When cement is added to water hydration reaction takes place and this hydration process is necessary for hardening of concrete. Self curing admixtures is incredibly important from the point of view that saving of water is a necessity everyday (each one cubic meter of concrete requires 3 m³ of water in a construction, most of which is used for curing).

II. OBJECTIVES

- ✚ To study the Workability parameter of self curing concrete of grade M20 by conducted fresh concrete test i.e. Slump flow test.
- ✚ To study the strength parameter of self curing concrete of grade M20 by conducted of hardened concrete test i.e. Compressive strength test .
- ✚ To compared results of M20 grade for normal concrete with M20 self curing concrete.

III. LITERATURE REVIEW

- ¹ B. Mohan , investigated that addition of Self Curing Agent PEG400 0.5% on M20 Grade concrete mixture result in increased the compressive strength , split tensile strength.
- ² Mr. Vaseem Akram , investigated that addition of self curing agent PVA 0.5% , 1% , 1.5% , 2 % on M30 Grade concrete mixture result in increased Compressive strength , Split tensile strength.
- ³ R. Udhayan , Dr N.P Rajamane , investigated that addition of self curing agent PEG600 1% on M30 Grade concrete mixture result in increased the compressive strength & Superplasticiser used at dosage of 2 % by weight of cement.
- ⁴ Mr. Manvendra verma, Mr. Mayank nigam , investigated that addition of self curing agent PEG4000 1% on M40 grade of concrete mixture results in increased Compressive strength , Split tensile strength.
- ⁵ Dr. U.B Choubey , Mr. Gajendra Raghuvanshi ,investigated that addition of self curing agent PEG400 0.5% , 1% , 2% on M20 & M30 grade of concrete mixture results in increased Compressive strength.

IV. MATERIAL AND METHODOLOGY

Materials list: (1) cement , (2) Fine aggregate , (3) Coarse aggregate 10 and 20 mm , (4) water (5) Polyethylene Glycol-400 , (6) Polyvinyl Alcoholat , (7) Superplasticiser

- **Cement:** Ordinary Portland Cement 53 Grade used in this study.

- **Fine Aggregate:** The properties of sand were determined by tests as per IS 2386 (Part- I)

Table 1 Properties of Fine Aggregate

Properties	Sand
Sieve Analysis	Zone II
Fineness modulus	2.70
Specific Gravity	2.635
Water Absorption	1.19 %
Bulk Density	1.590 (Loose) 1.737 (Compacted)

- **Coarse Aggregate:** Coarse Aggregate of 10 and 20 mm were used. Coarse Aggregate conforming to IS 383-1987 was used.

Table 2 Physical Properties of Coarse Aggregate

Properties	20mm	10mm
Specific Gravity	2.876	2.865
Water Absorption	0.86%	0.83%
Aggregate Impact Value	14.07 %	16.16 %
Aggregate Crushing Value	16.1 %	18.4 %
Flakiness Index	10.23 %	9.86 %
Elongation Index	13.65 %	12.48 %
Bulk Density	1.56 (Loose) 1.74 (Compacted)	1.58 (Loose) 1.78 (Compacted)

- **Polyethylene Glycol 400:** The PEG 400 Physical Properties are tested as per standard procedure.

Table 3 Physical Properties of PEG 400

Property	Values	Unit
Clarity	Clear liquid	-
Odour	odorless	-
Sp. Gravity	1.1254	-
Form	Viscous liquid	-
Melting point	4 to 6	°C
color	Colorless	-
Acidity (CH ₃ COOH)	Maximum	%
Average molecular	380-420	g/ml
Density @ 20 C	1.120-1.126	g/ml



Fig 1 Polyethylene Glycol 400

- *Polyvinyl Alcohol* : The PVA Physical Properties are tested as per standard procedure.

Table 4 Physical Properties of PVA

Property	Values	Unit
Color	White	-
Odour	odorless	-
Sp. Gravity	1.19 - 1.31	-
Molecular weight	44.05	g/mol
Melting point	200	°C
Solubility in water ph	Moderately	-
Poisson's ratio	0.42 and 0.48	-
Chemical formula	(C ₂ H ₄ O) _x	-



Fig 2 Polyvinyl Alcohol

Table 5 Mix Design of M20 Grade Concrete

Mix	Materials						
	PEG 400 (%)	PVA (%)	Cement (Kg/m ³)	F.A (Kg/m ³)	C.A (Kg/m ³)	Water (Lit)	W/c Ratio
M20	-	-	343.6	717.8	1189.4	189	0.55
M20 G1	0.5	-	343.6	717.8	1189.4	189	0.55
M20 G2	1.0	-	343.6	717.8	1189.4	189	0.55
M20 G3	1.5	-	343.6	717.8	1189.4	189	0.55
M20 A1	-	0.5	343.6	717.8	1189.4	189	0.55
M20 A2	-	1.0	343.6	717.8	1189.4	189	0.55
M20 A3	-	1.5	343.6	717.8	1189.4	189	0.55

Table 6 Combination of Mix Proportion for M20 Grade and M40 SCC

Mix grade	M20 (Kg/m ³)	M40 SCC (Kg/m ³)
Cement	343.6	425
Fine Aggregate	717.8	743.6
Coarse Aggregate	1189.4	1215.9
Water	189	153
w/c ratio	0.55	0.36
Chemical admixture	-	4.25

V. RESULTS

Workability:

The Slump test is used for the measurement of a properties of fresh concrete as per IS: 1199 - 1959

Table 7 Slump Test PEG400 & PVA Results for M20 Grade Fresh Concrete

Grade	PEG400-0.5%	PEG400-1%	PEG400-1.5%	PVA-0.5%	PVA-1%	PVA-1.5%
M20	100 mm	112 mm	140 mm	60 mm	65 mm	72 mm

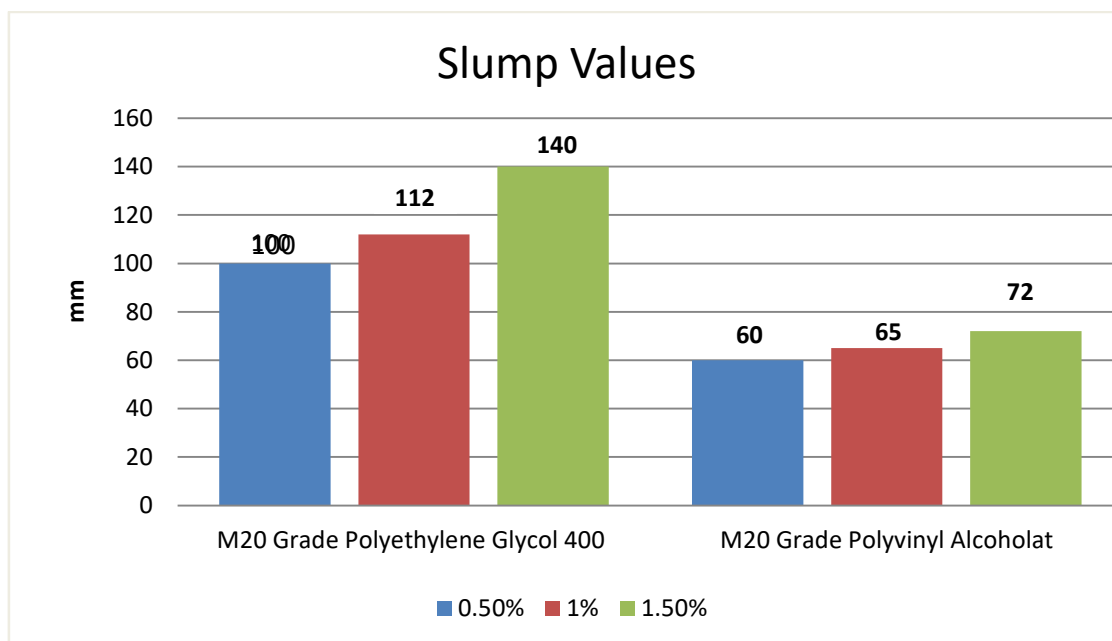


Fig. 4 Slump Flow Test PEG400 & PVA Comparison Graph for M20 Grade Fresh Concrete

Compressive Strength Test :

- Determination of compressive strength using by cube, a cube size is 150x150x150 mm and this test was performed on a 2000 KN capacity compression testing machine.
- Bureau of Indian Standards suggests that the compressive strength of concrete be considered as the basis for determining all properties and studying response of concrete. As such more emphasis was given on this test. The compressive strength of concrete was evaluated at the age 28 days.
- The compressive strength of cube specimen is calculated using the following formula:

$$\sigma = P/A$$

Where, P = failure load

A = cross sectional area of cube in mm

Table 8 M20 grade PEG400 & PVA Compressive Strength Test Result

Grade	PEG400-0.5%	PEG400-1%	PEG400-1.5%	PVA-0.5%	PVA-1%	PVA-1.5%
M20	27.4 N/mm ²	28.3 N/mm ²	26.63 N/mm ²	21.12 N/mm ²	21.5 N/mm ²	22.53 N/mm ²

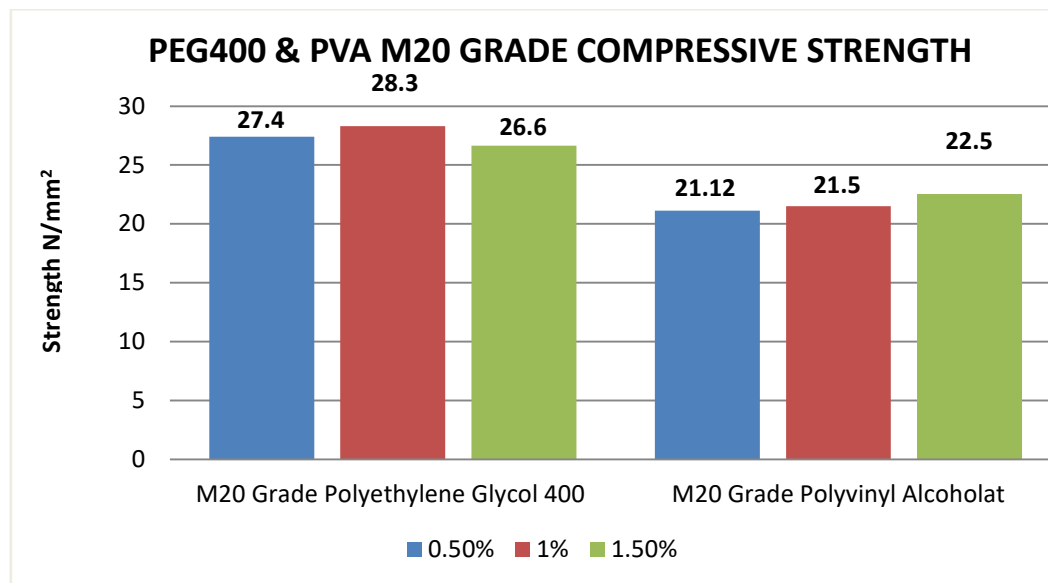


Fig. 5 PEG400 & PVA Compressive strength test Comparison Graph for M20 Grade Concrete

VI. CONCLUSION

- ✚ Mixing of self curing agent PEG 400 0.5% , 1 % , 1.5 % increased the workability of concrete.
- ✚ The Strength of self curing agent PEG 400 is increased by adding 0.5%,1 %.
- ✚ The Strength of self curing agent PVA is increased by adding 0.5 %,1 % , 1.5 %.
- ✚ Maximum Compressive strength of M20 grade of concrete After 28 days of PEG 400 1 % mix concrete is 29.10 Mpa.
- ✚ Maximum Compressive strength of M20 grade of concrete After 28 days of PVA 1.5 % mix concrete is 22.53 Mpa.

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