

Physical Parameters of Self Curing Concrete

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Abstract: *Since we identify water shortage is mounting day by day, so an important research should be needed to do the constructions without water. In early stages, water was mandatory for the curing purposes in construction. Curing of material do a main role for rising pore structure and microstructure to increase durability and performance with water-absorption material as self curing agent natural fibre (Sawdust). So, This paper highlights the effect of curing with the help of natural fiber (Sawdust). 5%, 10% and 15% of cement replaced with 5%, 10% and 15% of sawdust in the concrete. Adding 0.5%, 1% and 1.5% of calcium lignosulphonate for strength. The property such as compressive strength and water absorption of concrete was examined with normal curing cubes and self-curing cubes at 7 days and 28 days for M20 grade of concrete. Formula of Sodium lignosulphonate is $[R-SO_3]_2Ca(CaCO_3)_n$ is yellow brown soluble powder was used in curing than the conventional curing of concrete. Self-curing concrete has higher tensile strength than conventional concrete*

1. INTRODUCTION

Construction industry is growing like day by day even in remote areas and desert regions also. Even India and other countries are facing lot of problems in supplying drinking water to their citizens. Hence, Construction industries are under pressure in finding out alternative curing methods for Curing of Concrete. Self Curing Concrete is the one which can meet the present and future requirement of Curing Concrete. As a result successful and recent test and research, have recently put external self curing in the forefront of the breakthrough of ideas of how to make better concrete.

Sometimes curing plays a chief function in the growth of concrete properties throughout construction. Curing is often used to provide the method by which hydraulic cement concrete mature and increase hardened property more than time as a product of the constant hydration of the cement in the occurrence of enough water. The function of curing is to lessen water disappearance from concrete and keep acceptable moisture content, especially throughout early ages, for continuance of the hydration method that is essential for the growth of cement microstructure. This will lead to a improved class cement adhesive and concrete and will help to attain the preferred properties. though, good curing is not realistic in lots of cases and a amount of researchers have questioned whether it is feasible to set up self-curing concrete. It will establish that the improvement of using self-curing agent like natural fibre (sawdust) is

to lessen water fading from concrete, therefore rising its water preservation capability compare with that of conservative concrete and that water-absorbing material is sawdust may have this potent.

Building industry make use of bunch of water in the name of curing. The days are not far-off that all the building industry has to button over to an substitute curing system, not simply to save water for the sustainable growth of the atmosphere but also to encourage inside and open-air construction behavior even in inaccessible areas where there is shortage of water.

2. MATERIALS AND METHODS

a. Sodium lignosulphonate

Sodium lignosulphonate are mainly for concrete

Mixture as water reducing additive. Sodium lignosulphonate is yellow brown powder completely water soluble, is naturally anionic surfactant of high molecular polymer, rich in sulfo and carboxyl group and has better water-solubility, surf-activity and dispersion capacity.

Sr. No.	INDEX ITEMS	STANDARD VALUES	TEST RESULT
1	Appearance	Dark Brown	Meets the requirement
2	Ligno-sulphonate	50% (min)	55
3	Dry Matter	92% (min)	94
4	Moisture Content	7.0% (min)	3.9
5	PH Value	7-11	8
6	Inorganic Salts (Na ₂ So ₄)	5.0% (max)	1.9
7	Total Reducing Matter	4.0% (max)	4.1
8	Water insoluble Matter	2.5%	1.3

b. Cement

In this study OPC 53 grade cement for design mix as per IS 12269-1987. The various properties of cement are found out i.e. compressive strength after 7 and 28 days, specific gravity, consistency and initial and final setting of cement as shown in Table,

no.	Characteristics	Value Obtained Experimentally
1	Specific gravity	3.15
2	Standard Consistency	31.5%
3	Initial Setting Time	110 Minute
4	Final Setting Time	248 minutes
5	Compressive Strength 1. 7Days 2. 28Days	- -

c. Sawdust

Sawdust is a by- product of drilling, grinding, cutting, sanding, or otherwise pulverizing wood with a saw or other tool; it is collection of fine particles of wood Kumar et al (2014). It is also the byproduct of certain animals, birds and insects which live in wood, such as the woodpecker

and carpenter ant (green, 2006). It can present a hazard in manufacturing industries, especially in terms of combustion. The main component of sawdust is particleboard. Particleboard is a major use of sawdust; wood pulp is an example of coarse sawdust.

d. Fine Aggregate

Fine aggregate, which may be granular material or crushed stone, is a fundamental component of concrete. The quality of the fine aggregate and the density of the fine aggregate both have a significant impact on the hardened qualities of the concrete.

Fine aggregate is chosen for its grading zoneII, zoneII condition of fine aggregate is present in our circle. particle geometry and surface characteristics, wear and skid resistance, soaking and surface moisture, then the concrete mixture will last longer, become sturdier, and cost less.

e. Coarse Aggregate

Coarse aggregate used in the experiment are mainly obtained from crashed stone with 20 mm and 10 mm size in 60:40 fraction respectively.

Characteristics	Discription
Colour of Aggregate	Grey
Shape of Aggregate	Angular
Size of Aggregate	20mm (60%) 10mm (40%)

3. TEST METHOD

A curing with the help of natural fiber (Sawdust). 5%, 10% and 15% of cement replaced with 5%, 10% and 15% of sawdust in the concrete. Adding 0.5%, 1% and 1.5% of sodium lignosulphonate for strength. The property such as compressive strength and water absorption of concrete was examined with normal curing cubes and self-curing cubes at 7 days and 28 days for M20 grade of concrete. Formula of Sodium lignosulphonate is $[R-SO_3]_2Ca(CaCO_3)_n$ is yellow brown soluble powder was used in curing than the conventional curing of concrete. Self-curing concrete has higher tensile strength than conventional concrete. Mixing all material like cement, sand, aggregate, sawdust and admixture (sodium lignosulphonate). compare normal cube with self curing concrete cubes.

Procedure Of Fineness Test On Cement

- Break down any air-set lumps in the cement sample with fingers.
- Weigh accurately 100 gms of the cement and place it on a standard 90 micron IS.sieve.
- Continuously sieve the sample for 15 minutes.
- Weigh the residue left after 15 minutes of sieving. This completes the test.

Procedure Of Standard Consistency Of A Cement Paste

- Unless otherwise specified this test shall be conducted at a temperature $27 \pm 2^\circ C$ and the relative humidity of laboratory should be $65 \pm 5\%$.
- Prepare a paste of weighed quantity of cement (300gms) with weighed quantity of potable or distilled water, taking care that the time of gauging is not less than 3minutes nor more

- than 5 minutes and the gauging is completed before any sign of setting occurs.
- The gauging is counted from the time of adding water to the dry cement until commencing to fill the mould.
 - Fill the vicat mould with this paste resting upon a non-porous plate.
 - Smoothen the surface of the paste, making it level with the top of the mould.
 - Slightly shake the mould to expel the air.
 - In filling the mould operators hands and the blade of the gauging trowel shall only be used.
 - Immediately place the test block with the non-porous resting plate, under the rod bearing the plunger.
 - Lower the plunger gently to touch the surface of the test block and quickly release, allowing it sink into the paste.
 - Record the depth of penetration
 - Prepare trial pastes with varying percentages of water and test as described above until the plunger is 5mm to 7mm from the bottom of the vicat mould.

Values Of Test On Self Curing Concrete

Consistency					
			Percentage of Sawdust		
Sr No.			5%	10%	15%
1	Percent of Addmixture	0.5%	35%	45%	56%
2		1.0%	34%	44%	55%
3		1.5%	33%	42%	52%

Initial Setting Time

- Immediately place the test block with the non-porous resting plate, under the rod bearing the initial setting needle.
- Lower the needle and quickly release allowing it to penetrate in to the mould.
- In the beginning the needle will completely pierce the mould
- Repeat this procedure until the needle fails to pierce the mould for 5 + 0.5mm.
- Record the period elapsed between the time of adding water to the cement to the time when needle fails to pierce the mould by 5 + 0.5mm as the initial setting time.

Final Setting Time

- Replace the needle of the vicat apparatus by the needle with an annular ring
- Lower the needle and quickly release.
- Repeat the process until the annular ring makes an impression on the mould.
- Record the period elapsed between the time of adding water to the cement to the time when the annular ring fails to make the impression on the mould as the final setting time.

Procedure Of Concrete Slump Test

- The mold for the concrete slump test is a frustum of a cone, 300 mm (12 in) of height. The base is 200 mm (8in) in diameter and it has a smaller opening at the top of 100 mm (4 in).
- The base is placed on a smooth surface and the container is filled with concrete in three

layers, whose workability is to be tested .

- Each layer is temped 25 times with a standard 16 mm (5/8 in) diameter steel rod, rounded at the end.
- When the mold is completely filled with concrete, the top surface is struck off (leveled with mould top opening) by means of screening and rolling motion of the temping rod.
- The mould must be firmly held against its base during the entire operation so that it could not move due to the pouring of concrete and this can be done by means of handles or foot - rests brazed to the mold.
- Immediately after filling is completed and the concrete is leveled, the cone is slowly and carefully lifted vertically, an unsupported concrete will now slump.
- The decrease in the height of the center of the slumped concrete is called slump.
- The slump is measured by placing the cone just besides the slump concrete and the temping rod is placed over the cone so that it should also come over the area of slumped concrete.
- The decrease in height of concrete to that of mold is noted with scale. (usually measured to the nearest 5 mm (1/4 in)).

Sieve Analysis Of Coarse And Fine Aggregates

- The test sample is dried to a constant weight at a temperature of $(110 \pm 5^\circ\text{C})$ and weighed.
- The sample is sieved by using a set of IS Sieves.
- On completion of sieving, the material on each sieve is weighed.
- Cumulative weight passing through each sieve is calculated as a percentage of the total sample weight

MIX DESIGN :-

Data Of Mix Design				
Note:- Refrence Form (IS-10262:2019 OR IS-456:2000) and Tests				
Sr no	Description of Item	Value	Unit	Remark
1	Grade of Concrete M20	20	N/mm ²	Charecterstics Compressive Strength Required In Field at 28 Days = 20 Mpa
2	Type of Exposure = Moderate			(IS-456:2000, Table3, Pg no-18)
3	Desing Mix Target Strength of Slump	75	mm	
4	Size of Coarse Aggregate	20	mm	
5	Fine Aggregate	Zone II		
6	Grade of Cement	OPC53		
7	Sp Gravity of Cement	3.15		
8	Sp Gravity of Water	1		
9	Sp Gravity of Addmixture	1.25		

10	Sp Gravity of Coarse Aggregate	2.73		
11	Sp Gravity of Fine Aggregate	2.46		
12	Water Absorption of Coarse Aggregate	(C.A = 0.86%)		} SSD = Surface Saturated Dry Condition
13	Water Absorption of Fine Aggregate	(F.A = 1.25%)		
14	Addmixture Percentage's	0.5		
		1.0		
		1.5		
15	Type of Aggregate	Angular		
16	Type of Concrete	Plan Cement Concrete		
17	Number's of Cube	80		

MIX DESIGN				
Sr no	Description of Item	Value	Unit	Remark
1	Target Mean Strength of Concret			
Case1	$F'ck = Fck + 1.65 S$			F'ck = Target Mean Compressive Strength at 28 days Fck = Charecterstics of Compressive Strength at 28 days S =Stander Deviation
	$F'ck = 20 + 1.65 \times 4$	26.56	N/mm ²	S =Stander Deviation (IS-10262:2019, CL-4.2.1.3, Table-2)
Case 2	$F'ck = Fck + X$			F'ck = Target Mean Compressive Strength at 28 days Fck = Charecterstics of Compressive Strength at 28 days X = Factor Based on Grade of Concret
	$F'ck = 20 + 5.5$	25.5	N/mm ²	X = Factor Based on Grade of Concret (IS-10262:2019, CL-4.2.1.3, Table-1)
	$F'ck = 26.56$ N/mm²	26.56	N/mm²	Take Max Value In Between Case1 or Case2
2	Water Cement Ratio			
	Water Cement Ratio Depend on Exposure = Moderate			(IS-456:2000, CL-8.2.2.1, Table3, Pg no-18)
	Should Have Take	0.6		(IS-456:2000, Table-5, Pg no-20)

	Max Value of Water Cement Ratio			
	From Chart Value	0.63		(IS-10262:2019, Pa no-4)
	Water Cement Ratio	0.5		(IS-456:2000, Table-5, Pg no-20)
3	Determine of Water Content			
	Coarse Aggregate (20mm)	186	Kg	Constant Value for 50 Slump In (IS-10262:2019, Table-4, Pg no-5)
	Water for 75mm Slump			
	$186 + (3/100 \times 186)$	191.58	Kg	As per (IS-10262:2019, CL-5.3, Pg no-4) Should Have Increase Water 3% For Every Addition of 25mm Slump
	Water Content	191.58	Kg	
4	Calculate of Cement Content			
	Cement Content = Water Used/ Water Cement Ratio			PCC- min 240 Kg/m ³ To 450 Kg/m ³ (IS-456:2000, Table-5, Pg no-20)
	$191.56/0.5$	383.16	Kg/m ³	Safe
	Cement Content	383.16	Kg/m³	
5	Calculate of Volume of Course Agg And Fine Agg.....(In Praportion)			
	Value of Coarse Aggregate	0.62		0.62 Value Is Given In IS Code For Water Cement Ratio 0.6 (IS-10262:2019, Table-5, Pa no-6)
	Maximum w/c Ratio - Chart value of W/c = value is negetive then Water/C Ratio is increased or If +ve Then decresed Ex:-0.6 - 0.63 = - 0.03	5.37		The proportion of volume of coarse aggregates to that of total aggregates is increased at the rate of 0.01 for every decrease in water-cement ratio by 0.05 and decreased at the rate of 0.01 for every increase in water- cement ratio by 0.05.... (IS-10262:2019, CL-5.5.1, Pg no-5)
	Value of Coarse Aggregate = $0.62 - 0.0075 = 0.612$	0.613		Ex:- 0.01 Decreased For W/C Ratio is 0.05 Hence, 0.0075 Decrease For W/C Ratio is 0.03
	Volume of Coarse Aggregate	0.613		

	Volume of Fine Aggregate	0.388		Value of Fine Aggregate = 1 - Volume of Coarse Agg
6	Calculation Of Mix Desing			
I)	Volume of Concrete	1	m ³	
II)	Volume of Cement			
	$383.16/(3.15 \times 1000) = 0.122$	0.122	m ³	Volume of Cement = Mass of Cement/(Sp Gravity x 1000)
III)	Volume of Water			
	$191.58/(1 \times 1000) = 0.192$	0.192	m ³	Volume of Water = Mass of Water/(Sp Gravity x 1000)
IV)	Volume of Entrapped Air			
	$1/100 = 0.01$	0.01	m ³	1% (For 20mm C.A) (IS-10262:2019, Table-3, Pg no-3)
V)	Volume of All Aggregate (Coarse + Fine)			
	$1 - (0.122 + 0.192 + 0.01) = 0.676$	0.677	m ³	Volume of All Aggregate (Coarse+Fine)= Volume of Concrete - (Volume of Cement + Volume of Water + Volume of Entrapped Air)
VI)	Mass of Coarse Aggregate	1131.64	Kg/m³	Mass of Coarse Aggregate = Volume of All Aggregate x Volume of Coarse Agg x Sp Gravity x 1000
VII)	Mass of Fine Aggregate	645.14	Kg/m³	Mass of Fine Aggregate = Volume of All Aggregate x Volume of Fine Agg x Sp Gravity x 1000

#	Praportion For Normal Trial Mix Desing			
	Cement	383.16	Kg/m ³	
	Water	191.58	Kg/m ³	
	Fine Aggregate	645.14	Kg/m ³	
	Coarse Aggregate	1131.64	Kg/m ³	(60% of 20mm or 40% of 10mm)
	Water Cement Ratio	0.5	Kg/m ³	

#	Coarse Aggregate	1131.6 64	Kg/m ³	
	60% of 20mm	679.00	Kg/m ³	
	40% of 10mm	452.67	Kg/m ³	

#	Surface Saturated Dry Condition (SSD)			
1	Water Absorption of Coarse Aggregate (C.A) = 0.86%	9.73		C.A = 0.86% x 1131.66
2	Water Absorption of Fine Aggregate (C.A) = 1.25%	8.06		F.A = 1.25% x 654.14

#	Praportion			
	Cement	383.16	1	
	Fine Aggregate	645.14	1.68	
	Coarse Aggregate	1131.6 64	2.95	

Quantity of Material			1 : 1.68 : 2.95	
Sr no	Description of Item	Value	Unit	Remark
	For 1 Cube			
	Volume of Cube (Dry Volume)	0.0033 8	m ³	Size of Cube = 0.15 x 0.15 x 0.15
	Wet of Volume	0.0052 0		Wet of Volume = 1.54 x Dry Volume =1.54 x (3.375x10 ⁻³)
1]	Cement	0.0009 22		0.00520/(1+1.68+2.95)
		1440		Volume of Cement
		1.328		0.00092 x 1440
		106.21	Kg/m ³	1.328 x 80(No of Cube is 80)
	Cement	106.21	Kg/m³	
2]	Sand	0.0009 22		0.00520/(1+1.68+2.95)
		0.0015 52		0.00092 x 2.08
		1602		Volume of Sand
		2.49		0.00155 x 1602

		198.96	Kg/m ³	2.49 x 80(No of Cube is 80)
	Sand	198.96	Kg/m³	
3]	Coarse Aggregate	0.0009 22		0.00520/(1+1.68+2.95)
		0.0027 23		0.00077 x 3.69
		1600		Volume of Coarse Aggregate
		4.36		0.00272 x 1602
		348.55 79		4.36 x 80(No of Cube is 80)
	Coarse Aggregate	348.55 79	Kg/m³	

4. CONCLUSION

We thing The optimum dosage of Sodium lignosulphonate for maximum strength (compressive, and modulus of rupture) will found for the M20.

Strength of self-curing concrete is on par with conventional concrete. As percentage of Sodium lignosulphonate increased slump increased for M20 grade of concrete. Self-curing concrete will the answer to many problems faced due to lack of proper curing. Self-curing concrete is an alternative to conventional concrete in desert regions where scarcity of water is a major problem.

5. REFERNCE

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