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Variation in Compressive Strength of M25 Grade Due to Variation in Curing Patterns

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Abstract—*Curing plays a vital role in strengthening the concrete. As per the availability and region various curing methods are used for gaining concrete strength. In current study effect of various methods of curing on compressive strength of concrete are studied. Obtained results are useful for checking the suitability of curing method on different locations. Concrete cube specimens of mix 1:1:2 were prepared having water cement ratio 0.50. The cube were cured using six methods (ponding, sprinkling, membrane curing, sand cover curing, gunny bag curing, curing with NaCl water). The cubes were cured for 7, 14, 28 days. All the curing methods were adopted then compressive strength of concrete cubes was determined in laboratory. Test results shows that the moist sand curing method give the maximum compressive strength of concrete specimen after 28 days curing.*

Keywords*: Curing, Membrane Curing, Compressive Strength.*

1. INTRODUCTION

Curing is that method of controlling the speed and extent the moisture loss from concrete throughout cement hydration curing is done once it's been placed in position or throughout the development of concrete components, thereby time is provided for the hydration of the cement to occur. Since the hydration of cement dose take time-days, and even weeks instead of hours. Curing ought to be in deep trouble a restricted period of time if the concrete is to attain its potential strength and durability. Curing should be undertaken for a reasonable period of time if the concrete is to attain its potential strength and durability. Curing can also control the temperature since this affects the speed at that cement might hydrates.

The curing period may depend on the strength required by the concrete, the purpose for which it can be used, and the ambient conditions, i.e. the temperature and relative humidity of the surrounding atmosphere. Curing of concrete is done till the cement hydration can proceed so as to allow for development of strength, durability and other mechanical characteristics. To obtain good concrete, the curing of concrete should be done by a suitable method which should be less time consuming and give a better strength. According to Neville (1996), curing is the name given to mechanism used for stimulate hydration of cement, and inhere of a control of temperature and moisture movement from the concrete. Price (1991) refers to curing as the process of preserve the concrete for a limited period of time after placement, to supply moisture for hydration of the cement, to deliver proper temperature and to protect the concrete from damage by loading or mechanical disturbance.

Curing is vital to keep the dampness misfortune from concrete since this dampness misfortune can produce the splits on solid surface. Curing should be possible by keeping the solid component totally drenched or however much wet as could be expected until the water-filled voids are considerably limited by hydration items. The compound response of curing depends on the hydration of bond. This hydration of bond is in charge of the solid quality. This show if the hotness of the encompassing air is in any event that high, at that point there will be no requirement for dynamic curing to guarantee general hydration in light of the fact that there will be little development of water between the solid and surrounding air

2. EXPERIMENT DETAIL

2.1. Materials

Generally for the casting of cubes cement, sand and aggregates are required. For the gunny bag curing gunny bags are used. For the membrane curing a plastic sheet is required. For the Curing with salt NaCl is used.

2.2. Preparation of concrete cubes

A standard mix ratio of 1:1:2 was used. this is due to the fact that it is the commonly used ratio on construction sites for reinforced concrete. Batching by means of weight was followed. all the concrete cubes was casted in same environment. The temperature of room was 27°C and relative humidity was 75%. The water-cement ratio used for the

mixture was 0.50 and maintained for all nextmixes. Water cement ration ought to be choose on the idea of workability and slump cone test. The concrete combination was prepared by using for fifty four cubes. The steel cube moulds for the test specimens had been cleaned thoroughly and the indoors faces oiled. The mixed concrete was placed into the mold in three layers. during the placing of each layer of concrete it is compacted by a metallic rod. The quantity of strokes should not be much less than 35. After compaction of the final layer, the top surface became smoothened by a hand trowel. The cubes were left in the moulds after compaction, so one can set and harden. at the end of this period, the concrete cubes specimens were taken out from moulds and they were put in their respective curing area.

2.3. Curing methods

2.3.1 Ponding

This is the high-quality approach of curing. it is suitable for curing horizontal surfaces inclusive of floors, roof slabs, avenue. in this technique the dice is immersed into the water for curing.

2.3.2 Sprinkling

Sprinkling of water constantly at the concrete surface provides a green curing. in this method water is sprinkle on concrete cube at regular periods.

2.3.3. Membrane Curing

In this technique of curing a water proof fabric is overspread at the wet concrete surface. This method of curing prevent the evaporation of water from the concrete.

2.3.4. Sand Cover Curing

In this method the cubes are covered from sand and curing is done at regular intervals. Sand can reduce the temperature and that is helpful to prevent the shrinkage.

2.3.5. Curing with NaCl water

This method is used to check the effect of salty water on concrete cube because at many places there are sea water available. If the curing is done by sea water then it will affect the strength of concrete.

2.3.6. Gunny bags curing

Gunny bag curing is used to reduce the amount of water in curing. This method is done to check the variation in compressive strength due to change in the curing pattern.

3. RESULT AND DISCUSSION

3.1. Material Properties

3.1.1. Properties of aggregates

Specific gravity of aggregates = 2.92

Fineness modulus of aggregates = 5.2

Water absorption test = 1.84%

3.1.2. Properties of sand

Specific gravity of sand = 2.66

Fineness modulus of sand = 3.50

Water absorption = 2.57

3.2. Compressive Strength

3.2.1. Compressive strength after 7 days

TABLE 1: Compressive Strength of Samples

Method of Curing	Sample Name	Compressive strength (N/mm^2)	Mean Strength (N/mm^2)
Ponding	A1	16.28	17.90
	A2	17.56	
	A3	19.86	
Sprinkling	A4	15.36	16.34
	A5	17.25	
	A6	16.40	
Gunny Bag curing	A7	16.90	16.79
	A8	15.98	
	A9	17.49	
Membrane Curing	A10	17.28	17.20
	A11	16.36	
	A12	17.96	
Sand Cover Curing	A13	21.36	20.64
	A14	20.41	
	A15	20.15	
Curing with NaCl water	A16	17.54	18.10
	A17	17.24	
	A18	19.50	

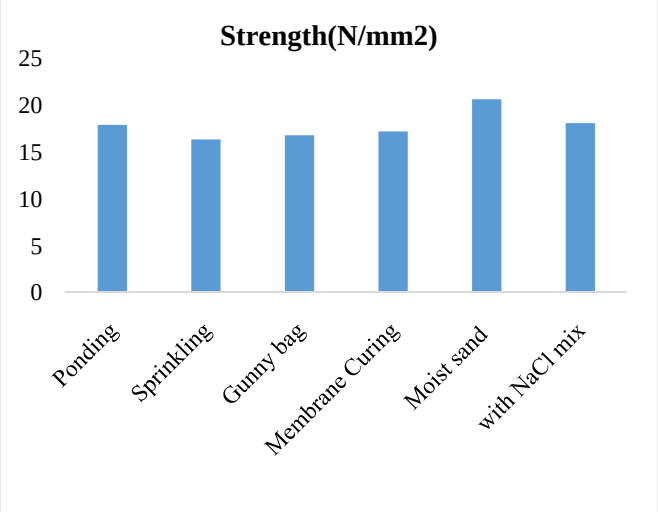

Fig. 1: Strength of various curing methods

Fig. 1 shows the compressive strength of M25 grade of 7 days curing period. The moist sand curing is giving the maximum compressive strength. The strength with NaCl mix water is

more than the normal ponding method. This shows that there is no decrement will come if we mix the salt (approximate sea water) with water. The bad strength of sprinkling method.

3.2.2. Compressive strength after 14 days

Table 2: Compressive Strength After 14 Days

Method of Curing	Sample Name	Compressive strength (N/mm^2)	Mean Strength (N/mm^2)
Ponding	A1	22.45	23.84
	A2	23.26	
	A3	25.81	
Sprinkling	A4	20.45	20.40
	A5	20.21	
	A6	20.54	
Gunny Bag curing	A7	21.40	22.48
	A8	22.98	
	A9	23.06	
Membrane Curing	A10	22.65	23.4
	A11	24.22	
	A12	23.33	
Sand Cover Curing	A13	25.14	26.45
	A14	28.16	
	A15	26.05	
Curing with NaCl water	A16	23.48	24.75
	A17	24.25	
	A18	26.52	

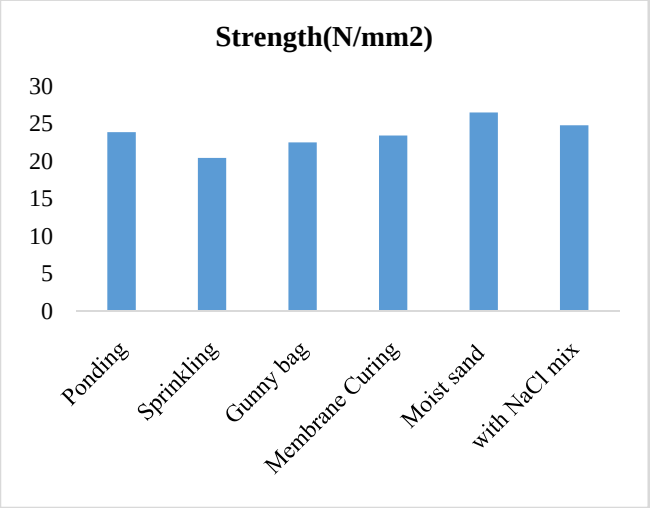

Fig. 2 Strength of various curing methods after 14 days

Compressive strength of concrete cubes after 14 days are shown in figure 2. In above result we can see that the maximum compressive strength is given by moist sand curing which is 26.45(N/mm^2). This is due to soil nature because soil can contain the moisture for long time. We can also see that there is a slight difference between the gunny bag curing and ponding. Curing with water proof material also give a slight difference in compressive strength from ponding.

3.2.3 Compressive strength after 28 days

Table 3: Compressive Strength after 28 Days

Method of Curing	Sample Name	Compressive strength (N/mm^2)	Mean Strength (N/mm^2)
Ponding	A1	25.9	26.6
	A2	26.8	
	A3	27.1	
Sprinkling	A4	23.6	23.5
	A5	23.45	
	A6	23.24	
Gunny Bag curing	A7	27.4	27.8
	A8	27.6	
	A9	28.42	
Membrane Curing	A10	26.53	26.0
	A11	26.14	
	A12	25.33	
Sand Cover Curing	A13	30.28	30.5
	A14	31.74	
	A15	29.48	
Curing with NaCl water	A16	27.43	28.5
	A17	29.23	
	A18	28.96	

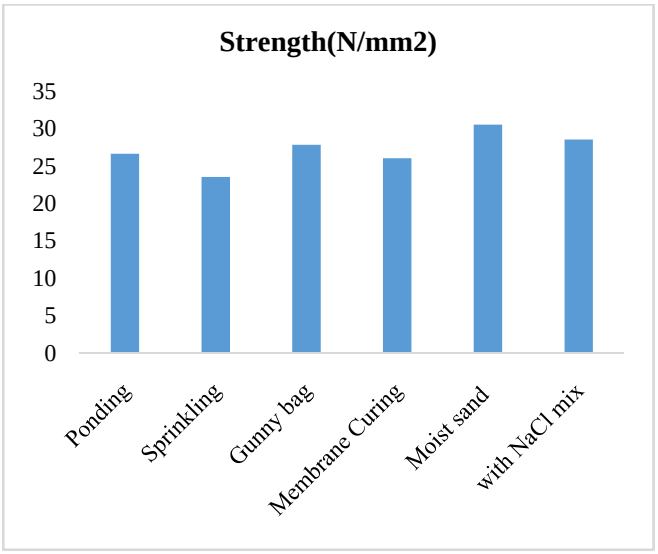

Fig. 3: Strength of various curing methods after 28 days

Above results shows that the maximum strength is given by moist sand curing method. If NaCl is mixed in water by small quantity then it give better result from normal curing. This result declare that if the salt is present at any location in small quantity then it will not affect the compressive strength of concrete. We can also see that the gunny bag curing method give good results in 28 days compare to normal ponding and it give the less strength from ponding for 7days, 14days curing period.

4. CONCLUSION

In all results it is observed that the moist sand curing method give the maximum compressive method from all other method. This is due to the soil properties because wet soil can contain the moisture for a long period. Gunny bag curing method give less compressive strength from normal ponding method for 7days, 14days curing period but it give more strength for 28 curing period because the pores in gunny bag can allow the passing of air. This method is suitable because it can reduce the quantity of water used. If the salt is present in small quantity then it will give the more strength compare to curing with normal water. Membrane curing method also give the same results compare to normal ponding. This method is suitable to reduce the quantity of water used for curing. Sprinkling method give the less strength from all other methods and consumes more water for curing. So, this method is not suitable for curing and it is also a time consuming process.

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