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Experimental study on Concrete curing agent using Calcium Bentonite powder without curing

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Abstract: Bentonite powder is considered to be the easily available and cost effective natural resources. This study covers the uses of Calcium Bentonite Powder as the main component for concrete curing agent to determine the properties of the concrete when comparing to normal water curing. Water is one of the most essential things in our life and it is demandable nowadays. To reduce the usage of water, here we are applying concrete curing agent and the results are discussed.

Key Words: Calcium Bentonite powder, Concrete curing agent, Demandable, Natural resources and water.

I. Introduction

Concrete curing agents were an important part of creating a strong durable concrete member. The article explored why they were necessary and the options for curing and sealing industrial concrete member. When concrete cured, water within the concrete evaporated. If water near the surface of a concrete slab evaporated too quickly, the concrete dried at the surface before drying further down the slab. A concrete curing agent formed a membrane over the top of the concrete slab while it cured. This stopped near the surface of the slab evaporating too quickly and hence helped to reduce cracking and dusting. When a slab had uniform strength it meant it could bear weight and withstand challenging environment more easily. So curing helped a concrete member performed to its full potential.

II. Materials and Methods

Cement

The type of cement used in this work was 53- grade OPC. The specific gravity of the cement was 3.15 and the fineness modulus was 7.5%

Fine Aggregate

Fine aggregate was river sand and having the specific gravity of 2.61 and its fineness modulus was 2.25%. The zone of fine aggregate was determined by Sieve analysis. As per Indian standards the zone obtained zone-II.

Coarse Aggregate

Coarse aggregate having a size of 12mm its specific gravity and fineness modulus were 2.65 and 5.96% respectively.

Calcium Bentonite Powder

The calcium Bentonite powder was bought from online. It was the main active ingredient of fuller's earth, probably one of the earliest industrial cleaning agents. It helped to reduce cracking and dusting when a slab had uniform strength.

TABLE 1: Properties of Calcium Bentonite Powder

Properties	Values
Swelling capacity	27.5 mins
Gelling time	2 mins
Moisture content	12%
pH	10

Fig 1. Calcium Bentonite powder

Magnesium oxide

It is a white hygroscopic solid mineral that occurs naturally as Pericles and is a source of magnesium are shown in Fig (4). It has an empirical formula of MgO.

Fig 2. Magnesiuoxide

Table 2. Properties of Magnesium Oxide

Properties	Values
Odor	Odorless
Density	3.6g/cm
Melting point	2825ºc
Boiling point	3600ºc

Mineral oil

It is any of various colorless, odorless, light mixtures of higher alkenes from a mineral source, particularly a distillate of petroleum. It reduces the heat generated when the surface moves.

Fig 3. Mineral oil Table 3 . Properties of Mineral oil

Properties	Values
Density	0.85g/ml @20ºc
Refractive Index	N/20D 1.467(Lit)
Flash point	185ºc
Color	Water
Water solubility	Insoluble

Mix Proportion

Control mixture for M20 grade concrete was designed as per IS: 10262-1982.The concrete mix is prepared normally but curing agents are prepared with a mixture of Calcium Bentonite powder, magnesium oxide, mineral oil and water with a percentage of 200 and 1500% from the weight of Calcium Bentonite powder and it is cured for 7, 14 and 28 days. For each variation 9 numbers of 150mm x 150mm cubes, 3 numbers of 150mm dia x 300mm cylinders and 700mm x 150mm prisms were cast and tested.

III. Testing of Concrete

Compressive strength test

One of the basic parameters for the concrete is compressive strength. It is known that concrete is good in compression and weak in tension. For a good concrete the compressive strength must relatively higher. The table shows the compressive strength of concrete with 200 and 1500% of water with bentonite mixture.

Compressive strength = (load) / (area)

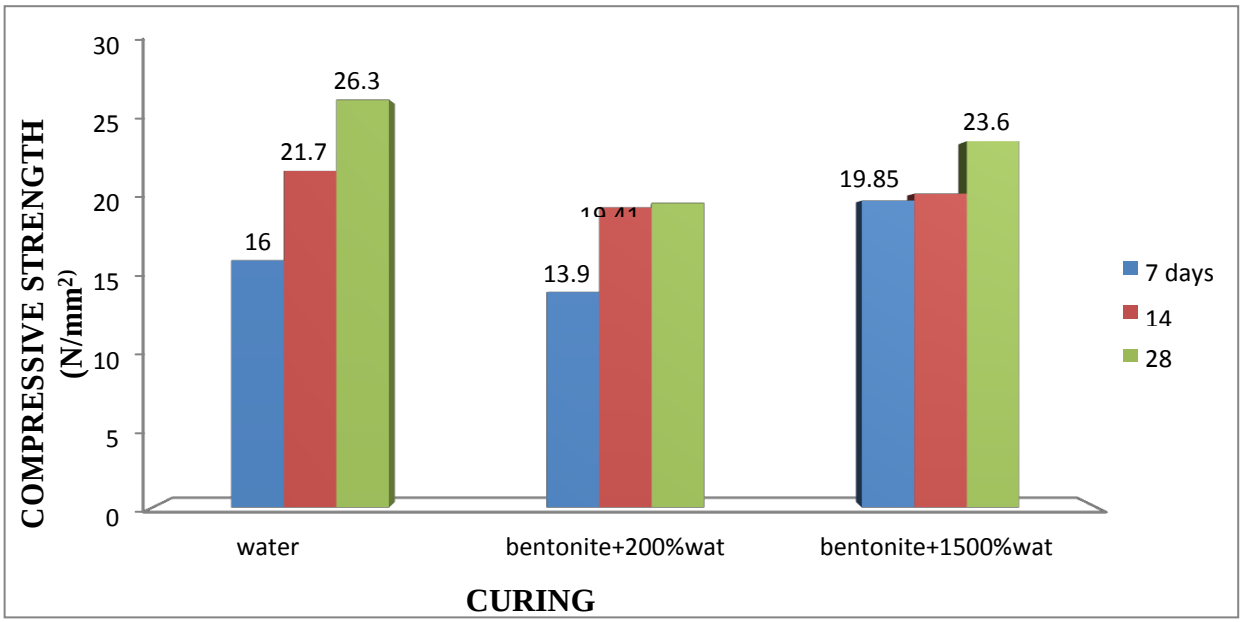

Fig 4. COMPRESSIVE STRENGTH OF CONCRETE

Split tensile strength test

With increase in the technology in construction field many innovative concrete have been developed such that the concrete having the capacity to withstand more tensile strength than its actual strength. By bentonite curing, the tensile strength of the concrete is also studied and the results are inferred. The formula used for the calculation of tensile strength of concrete is given below

Split tensile strength = (2P) / (πLD)

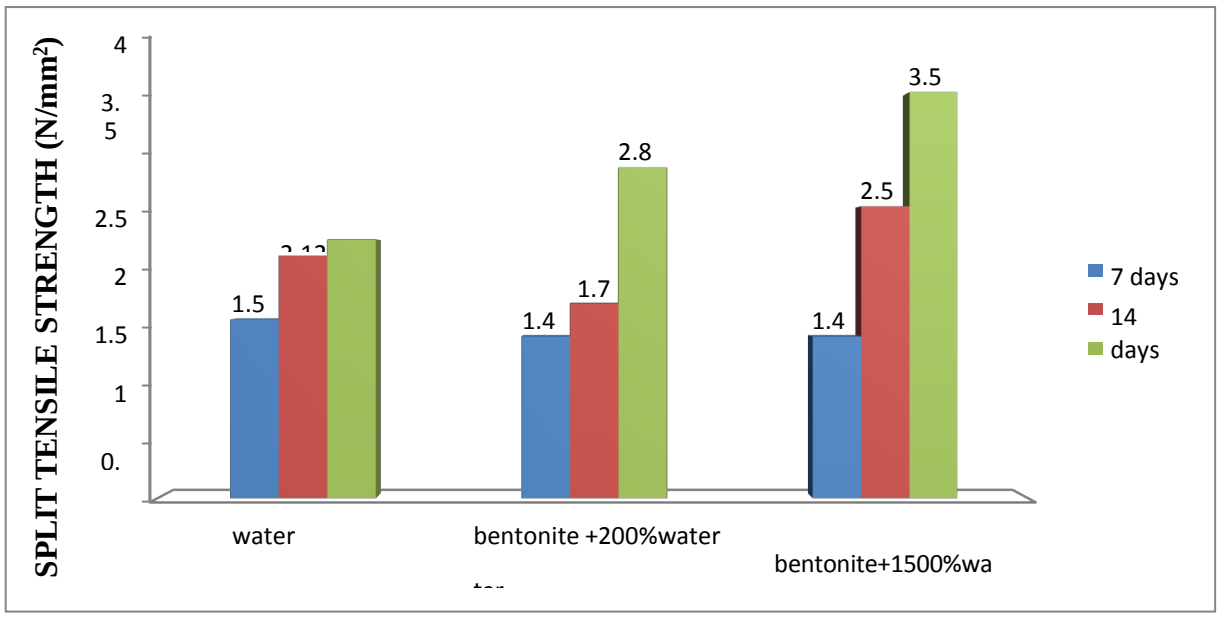

Fig 5. SPLIT TENSILE STRENGTH OF CONCRETE

Flexural strength test

The transverse bending test is most frequently employed, in which a rod specimen having either a circular or rectangular cross section bent until a fracture using a three point flexural test technique. The flexural strength represents the highest stress experienced within the material at its moment of rupture. The prism tests are found to be dependable to measure flexural strength.

Flexural strength = $3Pa / bd^2$

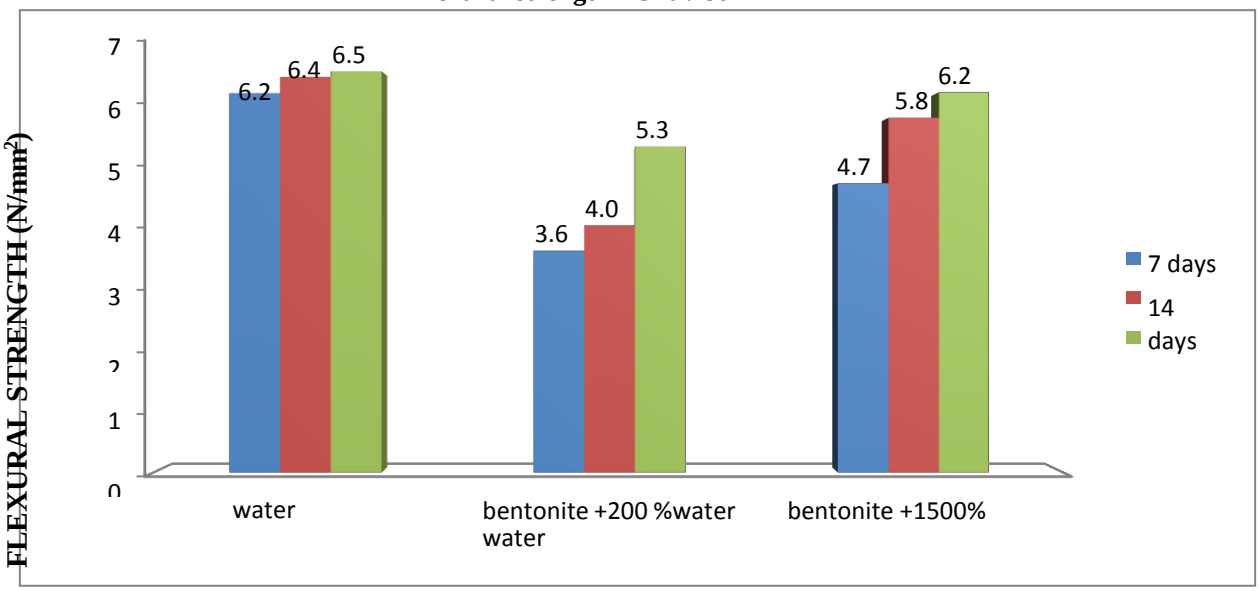

Fig 6. FLEXURAL STRENGTH OF CONCRETE

IV. Result and Discussion

In compressive strength,

1. Compare to design mix concrete, the compressive strength for bentonite curing with 200% of water is 17.31% decreased.
2. Compare to design mix concrete, the compressive strength for bentonite curing with 1500% of water is 0.47 % decreased.

In split tensile strength,

1. Compare to design mix concrete, the split tensile strength for bentonite curing with 200% of water is 1.01% increased.
2. Compare to design mix concrete, the split tensile strength for bentonite curing with 1500% of water is 26.26% increased.

In flexural strength,

1. Compare to design mix concrete, the flexural strength for bentonite curing with 200% of water is 32.45% decreased.
2. Compare to design mix concrete, the flexural strength for bentonite curing with 1500% of water is 12.95% decreased.

V. Conclusion

1. The addition of calcium bentonite powder, magnesium oxide, mineral oil and certain percentage of water formed gel is mainly working as the coated strength giving material and it gives strength greater than normal water curing.
2. The strengths were increased for split tensile strength and it is decreased for both compression and flexural strength test.
3. If the percentage of water to be added for preparing gel is increased, then the results may also get increased.

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