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ANEXPERIMENTALSTUDYONINTERNALLYCURINGCONCRETEWITH SAP AS SELF CURING AGENT

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ABSTRACT

To imagine a world devoid of concrete would be an absurd exercise in imagination. Infrastructural souls are made of it. Structures require concrete to be strong. Curing is required to provide the desired strength in conventional concrete, which is a mixture of cement, fine aggregate, coarse aggregate, and water. There is a pressing need to conserve water in the production of concrete and in the construction of buildings since water is becoming increasingly limited. In order to build strength, curing is more important, and a lack of proper curing can have a negative impact on the concrete's strength and longevity.

Self-curing concrete is a type of modern concrete that cures itself by retaining water in the mixture.(moisturecontent)init.Theuseof

SUPER ABSORBENT POLYMER Adding an additive to traditional concrete improves the hydration and thus the strength of the material. Water is becoming a more scarce resource every day, so study into water conservation in concrete production and building is an absolute necessity. Concrete curing is the process of ensuring that the concrete has the right amount of moisture in order to achieve the desired qualities. When concrete is cured, its microstructure and pore structure are improved, making it more durable and able to function better. An effort has been

Keywords:Super Absorbent Polymer (Sap), Water Retention, Compressive Strength, Workability, Water Savings are all terms used to describe self-curing concrete.

I.**INTRODUCTION**

Concrete has been and will be, for a considerable numberofyearsthemostversatilematerialsused in progress. When compared to other construction materials, concrete has a distinct advantage because of its unique capacity to adopt any shape in varied applications whether it is produced on the site or whether it is prepared in a factory as pre-cast. Concrete technology has advanced rapidly during the last two decades. To envision a world free of concrete is simply not possible. Infrastructures live and die by the concrete they're built on. Structures require concrete to be strong. In order for conventional concrete to attain the requisite strength, it must be cured. For this reason, a minimum of 28 days of curing is required to attain the desired moisture and strength.

Increasingly popular in recent decades, internal curing of concrete is moving beyond the confines of the laboratory and into the real world. The term "internal curing" is used to describe a process in which the Hydration of cement happens due to the presence of additional internal water that is not i

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ncluded in the mixing water. Self-curing agents can be used to make concrete that is internally cured. Internally cured agents are designed to limit the evaporation of water from the concrete, thus enhancing the concrete's water-holding capacity.

SCOPEOFTHEWORK

According to the above-mentioned objectives, the following is the scope of this investigation: Curing is the most critical step in the process For concrete structures, a process of 28 days of watering in a sympathetic atmosphere is required.

Because of this, scientists are investigating ways to cure materials using little or no water while still maintaining their compressive strength.

This problem can be solved by using self-curing chemicals, such as SAP, to create internally cured concrete.

Since compressive strength is one of the most important mechanical properties of concrete, this study will focus on measuring it.varying the percentage of SAP from 0% to 2% by weight of cement for M20 and M25 gradeof concrete.

OBJECTIVEOFTHEPROJECT

- Internallycuredconcretewithadmixture
- SAPisaddedintheconcretemixdesign
- MixgradesofM20andM25was done
- Cubes, Cylinders and Beams were casted with mix design by adding 0, 0.5, 1, 1.5, 2% SAP.
- Finally, strength was calculated for each of the specimens

II. LITERATUREREVIEW

 As a self-curing agent, Stella Evangeline used poly vinyl alcohol. Poly vinyl alcohol at a concentration of 0.48 percent by weight of cement provided compressive, tensile, and flexural strengths that were superior to those of the standard mix at a concentration of 0.03-0.48 percent by weight of cement.

 Mohammed Shafeeque, Gopikrishna used PEG600 as a self-curing agent in concrete by Sanofar PB, Praveen kP and Nikhil vP. The experiment will use concrete grades M20 and M25. For M20 and M25 grade concrete, PEG600 was added at a rate of 0 to 2% by weight of cement. Using this information, they determined that 1% PEG600 by weight of cement was ideal for M20 and M25 grade concrete in order to attain maximum strength.

 In ShikhaTyagi's words: PEG400, a self-curing agent in concrete, was the subject of research on self-curing concrete. Concrete grades M25 and M40 are used in the study. For M25 and M40 grade concrete, she added 1-2 percent of PEG400 by weight of cement. PEG400 dose for maximal compressive strength was found to be 1 percent for M25 concrete and 0.5 percent for M4O concrete, according to her.Dayalan J had used super absorbent polymers as a self-curing agent in concrete. He was added 0.0-0.48% of super absorbent polymer by weight of cement for M25 grade concrete. He was found that super absorbent polymer 0.48% by the weight of cement provideshigher compressive, tensile as well as flexural strength than the strength of conventional mix.

 Swamyet. al.presented a simple method to obtain a 50MPa 28-day strength concrete having 50 and 65 percent by weight cement replacement with slag having a relatively low specific surface. The compressive and flexural strengths and the elastic modulus of these two concretes as affected by curing conditions are then presented. Without any water curing, concrete with 50 percent slag replacement reachednearly90percentofitstargetstrength strength improvement of about 50 MPa at 28 days 14 and continued for next 6 months. A 7-day wet curing was found to be insufficient for high levels of slag replacement, and further drying exposure can have a negative impact on the long-term durability of concrete with an improperly cured slag.

A self-curing additive was discovered to have a wide range of effects on concrete's physical properties and powder X-RAY diffraction characteristics throughout the formation of internally cured concrete. At low dosages, researchers found enhanced permeability and increased strength in two computer models. An disruption of the natural C-S-H gel structure appears to have a deleterious influence on the concrete's compressive strength at high dosages, but this change is helpful because it produces a highly impermeable concrete. However, it was suggested that, despite a decrease in strength, a lower permeability of the same strength may be achieved.Tarun R. Naiket. al. Influence of microstructure on the physical properties of self-curing concrete has been studied. The Potential benefits from concrete using lightweight aggregate include: Better thermal properties, Better fire resistance, improved skid-resistance, reduced autogenous shrinkage, reduced chloride ion penetrability, improved freezing and thawing durability, an improved contact zone between aggregate and cement matrix and less micro-cracking as a result of better elastic compatibility.

III. MATERIALSANDPROPERTIES

The choice and type of materials used in the production of any sort of concrete is critical, as the material's qualities are entirely dependent on it.

Listed below are the materials that are currently being used. Cement

Small sand and gravel particles (sand)

Aggregates made out of recycled material (replacement of coarse aggregate)

- Wate
- SAP

Cement

Ordinary Portland Cement is the most widely used type of cement (OPC). The cement used is Ordinary Portland Cement (OPC) 53 grade, which meets the specifications of IS: 8112-1989. In the building industry, cement is a substance that sets, hardens, and binds to other materials, making it an essential component of the finished product.

S.No.	CHARACTERISTICS	VALUE
1	SPECIFIC GRAVITY	3.15
2	NORMAL CONSISTENCY	31%

AGGREGATES

Aggregates are inert granular materials such as sand, gravel or crushed stone that are an end product in their own right. They are also the raw materials that are an essential ingredient inconcrete.

Depending upon the size the aggregates are classified into two types

1) FineAggregate
2) CoarseAggregate

FineAggregate

Fine aggregate consists primarily of sands that have been mined from the land or the sea. Most fine aggregates consist of natural sand or crushed stone that falls under a 9.5mm sieve, which is the standard size for fine aggregates. Coarse aggregates can be derived from primary, secondary, or recycled sources, much like coarse aggregates can. The type of fine aggregate used has a direct impact on the concrete's strength, which in turn has an effect on how much water is used in the mix.Table:Propertiesoffineaggregate

S.No.	Physical Properties	Fine Aggregate
1	Size and Zone	4.75 mm down
2	Specific gravity	2.65
3	Water Absorption	1.4%
4	Moisture Adsorption	2%
5	Fineness modulus	3.95

RecycledAggregates

Recycled aggregates are made from the concrete waste that is collected after the demolition of concrete constructions. This project's concrete mix includes the proposed recycled aggregates.

Grading is used to shape the recycled aggregates. For partial replacement, 20 mm angular recycled aggregates were chosen in

accordance with the specification.

Figure: Recycled Aggregate Table:RecycledPhysicalProperties

S.No.	Physical Properties	RCA
1	Water absorption (%)	1.56
2	Specific gravity	2.63
3	Bulk Density (kg/ m^3)	1469.8

5 percent of the total weight of the finished product. A covalent cross-linking of the SAPs is seen. Copolymers of acrylamide and acrylic acid are used. A suspension polymerized SAP has an average particle size of 200 mm, whereas a solution polymerized SAP is crushed and sieved to produce particle sizes ranging from 125–250 mm. SAPs can be either spherical or rectangular in shape. Due to pore fluid absorption, the enlarged SAP particles in the cement pastes and mortars are approximately three times larger. The SAP's particle size distribution has a significant impact on swelling time. Swelling happens at a rate of 50% within the first 5 minutes after water is added.

WATER:

The chemical reaction between cement and water necessitates the use of water as an element in concrete. Due to the fact that it aids in the formation of the cement gel, great consideration must be given to the quantity and quality of water..

METHODOLOGY:

BatchingandMixing

By volume or mass, batching is the process of putting together a concrete mix. The precise proportions of fine aggregate, cement, coarse aggregate, and recycled aggregate in this recipe are determined through the use of weight batching. The design's mix proportions were calculated using weighing scales. Using a laboratory concrete mixer, we were able to mix up the correct amount of concrete. After a thorough mixing process yielded a uniform hue and a workable consistency, the concrete was transported into a tray and used to cast the examples. Preparation and Curation of Specimens

IV The concrete was put in the standard metallic molds in three layers and compacted with a tamping rod by providing 25 blows to the IS standard specimens that were cast. To make removal of the concrete from the molds easier, a thin layer of oil was applied to the mold walls before the concrete was placed inside. After the specimens' top surfaces had been smoothed off, the molds were placed on a needle vibrator for 10 to 15 seconds.

V **EXPERIMENTALINVESTIGATION**

In the present investigation according to IS standards the following dimensioned specimens were casted

- 150mm×150mm×150mmofcubes,
- 150mm×300mmofcylinders,and
- 150mm×150mmx700mmofbeams.

Thefollowing are the tests which was conducted in the project:

StrengthTests:

- Compressivestrengthtest
- Splittensilestrengthtest
- Flexuralstrengthtest

A. An examination of compressive strength

Crushing strength was evaluated using concrete cubes 150mm in size by 150mm in height by 150mm in width. Compressive strength is influenced by a variety of variables, including the w/c ratio, cement strength, the quality of the concrete mix, and the quality control procedures used during the production process. After curing for 7 days, 14 days, 28 days, and 56 days, these cubes are checked by compression testing machine. The specimen is put in the center of the machine's base plate, and a force of 140 kg/cm2 per minute must be applied progressively until the specimen fails.Breaking Strength of Split Tension

The tensile strength of concrete is one of the basic and important properties. Splitting tensile strength test on concrete cylinder is a method to determine the tensile strength of concrete. Because of its brittle nature, concrete isn't expected to hold up well under tension. Tensile stresses cause cracks to form in the concrete. If you want to know how much weight you can put on a concrete member before it breaks, you need to know its tensile strength. The splitting of cylinder is shown in figure. The cylinder's split tensile strength can be calculated using the following relationship: (1) Where Ft is split tensile strength, P= Ultimate load in KN L = Length of the cylinder in mm, D = Diameter of the cylinder in mm.

B. **FlexureStrength Test**

Concrete beam flexural strength test to determine the concrete's strength. In accordance with IS 516 – 1959, a flexural strength test was carried out. The test specimen was inserted in the machine at the bearing surfaces of the supporting and loading rollers using 150mm 150mm 700mm beams.

F = PL/BD2 P, where P is the load in kilograms. L and B are the measurements for length and width, respectively, in millimeters.

In millimeters, D is the distance from the top to the bottom. When expressed in N/mm, flexure strength equals f.

VI **RESULTS**

The results completed in the present investigation are reported in the form of Tables and Graphs for various percentage of recycled aggregate as a replacement to coarse aggregate. The following are thepercentagesreplacementofcementi.e.0to2%

withSAPand100%replacementofcoarseaggregate with recycled aggregate

SLUMPTEST

Slump test is used to determine the workability of fresh concrete.

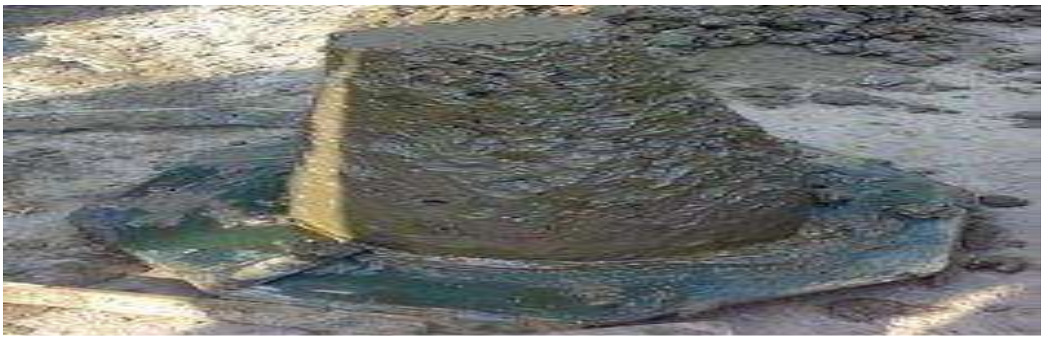
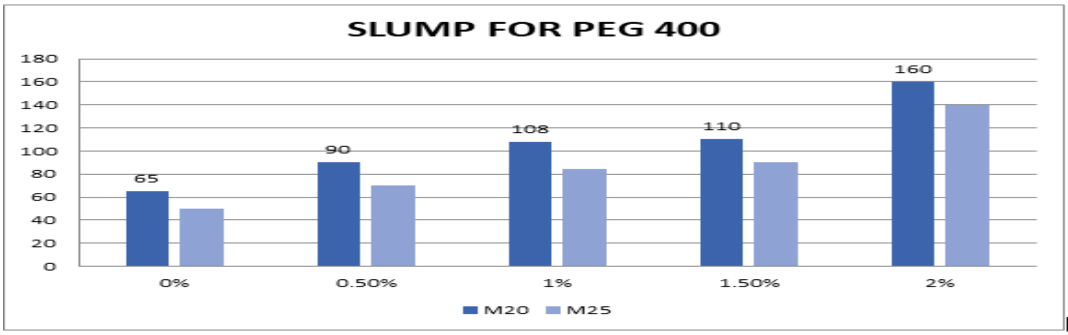


Fig.:Slumpconetest

Table:Slumptestforself-curingconcrete(SAP)

S.No.	PEG-400	M20	M25
1	0%	65	50
2	0.5%	90	70
3	1%	108	84
4	1.5%	110	90
5	2%	160	140

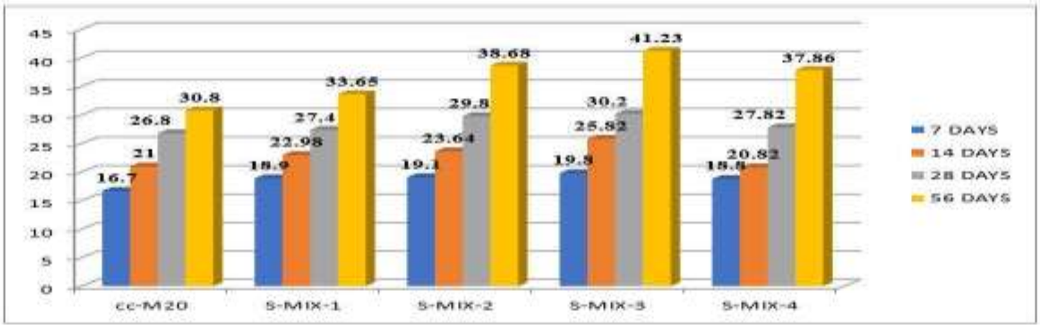


Slumptestforself-curingconcrete(SAP)

- COMPRESSIVESTRENGTH

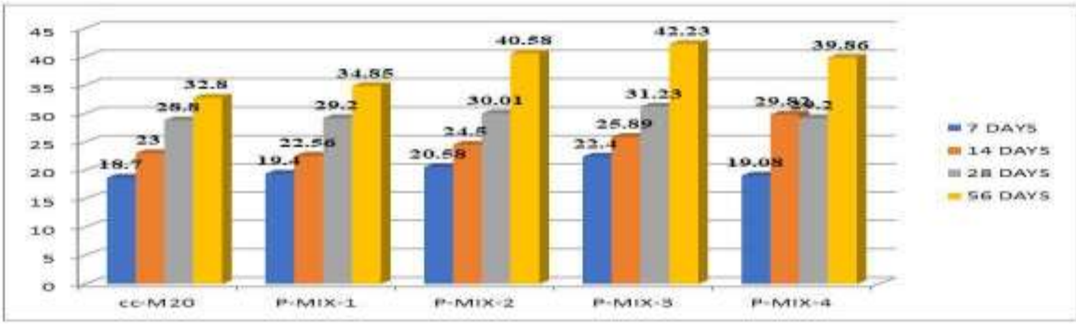
Table:Compressivestrengthofconcretewith mix design of M20 (SAP)

Mix id	7 DAYS	14 DAYS	28 DAYS	56 DAYS
CC	16.7	21.0	26.8	30.8
S-MIX-1	18.9	22.98	27.4	33.65
S-MIX-2	19.1	23.64	29.8	38.68
S-MIX-3	19.8	25.82	30.2	41.23
S-MIX-4	18.8	20.82	27.82	37.86



Mix id	7 DAYS	14 DAYS	28 DAYS	56 DAYS
CC	18.7	23.0	28.8	32.8
P-MIX-1	19.4	22.56	29.20	34.85
P-MIX-2	20.58	24.5	30.01	40.58
P-MIX-3	22.4	25.89	31.23	42.23
P-MIX-4	19.08	29.82	29.2	39.86

Fig.:Compressivestrengthofconcretewithmix design of M25 (SAP)



- SPLITTENSILESTRENGTHTEST

Table:Splittensilestrengthofconcretewithmix design of M20 (SAP)

Mix id	7 DAYS	14 DAYS	28 DAYS	56 DAYS
CC	1.8	2.02	2.82	3.5
S-MIX-1	2.5	2.8	3.4	3.89
S-MIX-2	2.8	3.2	3.6	4.2
S-MIX-3	3.2	3.8	3.87	4.6
S-MIX-4	3.0	3.25	3.52	4.47

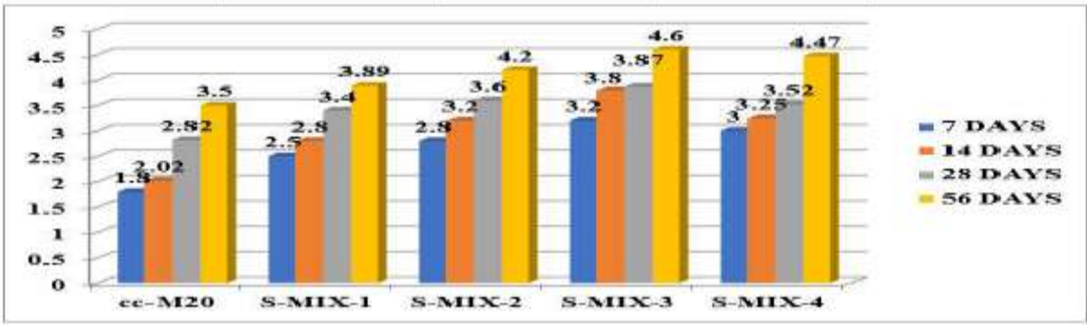


Fig.:Splittensilestrengthofconcretewithmix design of M20 (SAP)

Table:Splittensilestrengthofconcretewithmix design of M25 (SAP)

Fig.:Splittensilestrengthofconcretewithmix design of M25 (SAP)

- FLEXURALSTRENGTHTEST

Mix id	7 DAYS	14 DAYS	28 DAYS	56 DAYS
CC	2.2	3.18	3.7	4.2
S-MIX-1	2.7	3.32	4.01	4.8
S-MIX-2	2.92	3.92	4.23	5.21
S-MIX-3	3.18	4.02	4.68	5.6
S-MIX-4	3.01	3.82	4.32	5.23

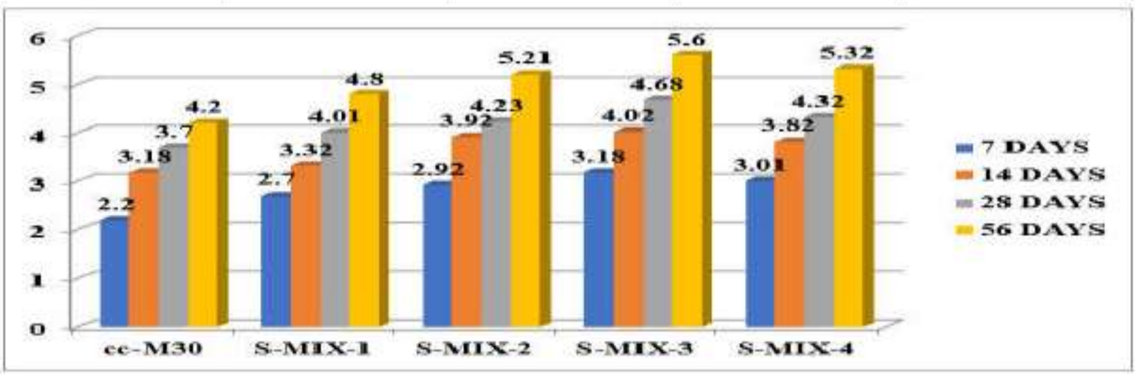


Table:FlexuralStrengthofconcretewithmix design of M20 (SAP)

Mix id	7 DAYS	14 DAYS	28 DAYS	56 DAYS
CC	2.2	2.45	2.98	3.52
S-MIX-1	2.38	2.9	3.28	4.2
S-MIX-2	2.45	3.25	3.68	4.68
S-MIX-3	2.92	3.68	3.92	4.99
S-MIX-4	2.8	3.18	3.85	4.62

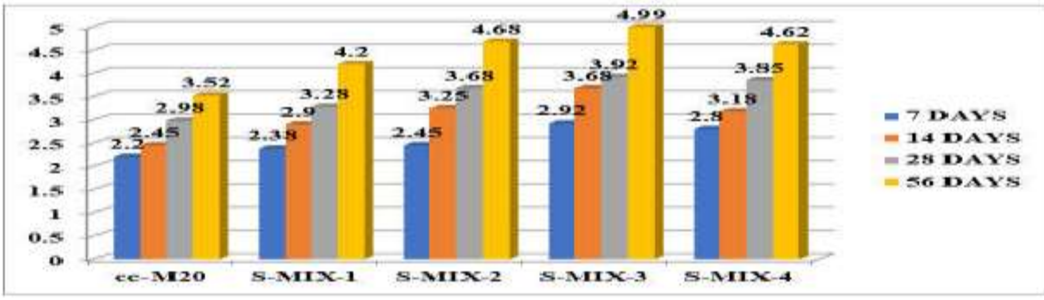


Fig.:Flexuralstrengthofconcretewithmix design of M20 (SAP)
Table:Flexuralstrengthofconcretewithmix design of M25 (SAP)

Mix id	7 DAYS	14 DAYS	28 DAYS	56 DAYS
CC	2.8	3.2	3.9	4.2
S-MIX-1	3.08	3.8	4.32	4.92
S-MIX-2	3.57	4.02	4.69	5.06
S-MIX-3	3.98	4.32	4.97	5.98
S-MIX-4	3.62	4.16	4.85	5.84

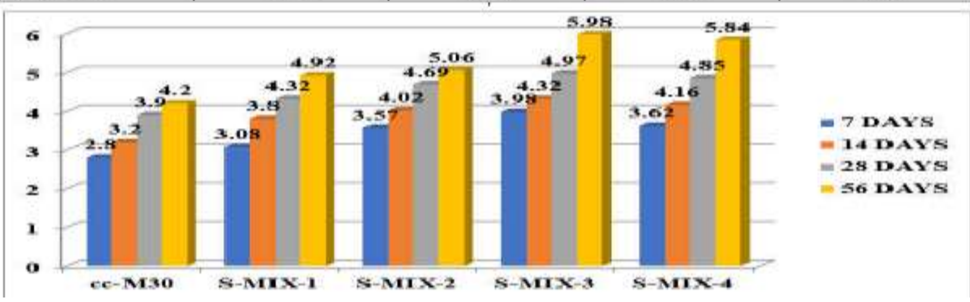


Fig.:Flexuralstrengthofconcretewithmix design of M25 (SAP)

VI. CONCLUSIONS

It was discovered that the self-curing agent SAP was effective.

In order to achieve maximum strength, a specific dosage percentage was established to be optimal for each grade of concrete.

At the optimal dosage, SAP yields greater outcomes, however overdosing on it might weaken concrete.

Furthermore, it was determined that the ideal dosage for M20 was 1.5 percent, which is the same as the remaining M25, thus we can deduce that with the rise in dosage of SAP in concrete, the strength decreases by 2%.

Concrete with a SAP dosage of 0.5-2 percent has a better compressive strength than conventionally cured concrete.

Strength decreases as the amount of SAP in a concrete mix is increased.SAP has been shown to boost the workability of concrete, allowing it to flow more easily.

Use of SAP to make an internally cured concrete that does not require external curing water does not compromise its strength, we conclude. Internally cured concrete does not require a curing process, hence all of the curing water can be preserved.

Traditional concrete was just as expensive as internally cured concrete. "

FUTURE SCOPE OF INTERNALLY CURED CONCRETE by SAP:

 It can become a new practice in construction field of replacing conventional concrete with internally cured concrete to skip curing process.

 Research on internallycured concrete in hot and cold weather condition can be done.

 Many other properties of concrete can be study such as chemical and physical properties.

 Many other properties of concrete can be study such as chemical and physical properties.

 Taking present scenario, saving water should be given more priority than money so with the same economic factors of concrete of bothconventional and internally cured concrete, we should start adopting internally cured concrete technique in construction field.

 In further studies we can replace cement with some cementious materials (by products) by adding SAP i.e. self-curing concrete

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