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BEHAVIOUR OF CONCRETE WITH CEMENT IS PARTIALLY REPLACED WITH MARBLE DUST AND POLYPROPYLENE FIBRE

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ABSTRACT

Concrete ingredients are different material like binding material (cement+ fly ash), fine aggregate, coarse aggregate and water. Today construction cost is very high with using conventional materials due to unavailability of natural materials. This problem can be solved by total replacement of concrete with different material which is not convenient in terms of required properties. Due to this limitation of unavailability of material which plays the vital role of concrete we have only choice of partial replacement of concrete ingredients. Rate of the cement production every year over worldwide is around 3 billion tons. Cement is the binding material which is important for building sector. Emission of CO2 due to cement industry is around 7% of worldwide. the earth is experiencing an environmental catastrophe in terms of contamination of the soil, air, and water. Industrial wastage is dumped on dumping yards, rendering the land unsuitable for agricultural use. To help the environment, these waste items can be reduced, reused, or recycled. Some waste materials, such as marble dust and granite powder, can be utilized as a partial replacement for cement in concrete for construction purposes. Polypropylene Fiber is a thermoplastic polymer which adds adhesive force due to its nature and hold the concrete mix together, reducing bleeding, shrinkage (both plastic and elastic), and cracks. Marble dust is also added to the mix in replacement of cement by 10% weight and the fibers used in quantity of 0.5% to 2%.

Keywords: Marble dust, polypropylene fiber, cement, compressive strength.

I. INTRODUCTION

• Concrete is a mixture of aggregates such as coarse aggregate, fine aggregate and cement, sand. Other additive and admixtures may be present. It is the world's most essential building material, and humans have been utilizing it for a long time. Aggregate is the most important component after cement to employ in concrete. Cement is produced at a rate of over 3 billion tons per year. For the manufacture of concrete, the building sector relies on cement.

• Cement industry emissions account for around 7% of worldwide CO2 emissions. To lower this emission, we must limit cement usage. It has become a competitive building material due to its properties like relative economy and high versatility which meets a wide range of needs in general. The demand for concrete in today's infrastructure expansion is gradually increasing. Concrete without reinforcing is brittle in nature, which have very poor tensile strength and a limited strain capacity.

• Concrete constructions are subjected to a variety of harsh circumstances, including chemical attacks such as chloride, sulphate, and acid. These attacks have a negative impact on the concrete structures' durability. Corrosion, which is induced by chloride attack on hardened reinforced concrete, is the most significant effect. These chemicals seeped into concrete structures through fractures, corroding them and causing deterioration, which has an impact on the structure's durability.

• From past time fibers are used to provide the flexural and tensile strength of concrete since ancient times, and some academics have also researched about the effect which occurs after using fiber on various characteristics of the concrete. Since the time, many types of fibers, like carbon, steel, glass and as well as polypropylene fiber have been employed in concrete. The addition of fiber to concrete affects its brittleness and ductility. These chemicals seeped into concrete structures through fractures, corroding them and causing deterioration, which has an impact on the structure's durability.

• Polypropylene Fiber is a thermoplastic polymer that, because of its thermoplastic nature, adds to adhesive force and can hold the concrete mix together, reducing bleeding, shrinkage (both plastic and elastic), and cracks. Fiber scattered in concrete forms a bridge across fissures, allowing for some ductility after cracking. Fiber reinforced concrete may endure significant stresses across a relatively high strain in the post-cracking condition if polypropylene fibers are used that are strong enough and form excellent connections with the material. Polypropylene fibers of various sorts can be used to strengthen concrete, reducing the formation of cracks.

• Polypropylene fibers improve several qualities of concrete mixes, including tensile strength, flexural strength, toughness, and strength of the impact, and also define the failure modes. Polypropylene fiber is used because it binds the concrete mix together, slowing the settlement of coarse particles and reducing bleeding, which indirectly slows the rate of drying, resulting in less shrinkage. Polypropylene fibers resist fractures and offer strength as any other secondary reinforcement in hardened concrete. The fibers prevent cracks from propagating by holding the concrete together, preventing cracks from spreading wider or becoming longer. Polypropylene fibers, on the other hand, are effective near to where fractures begin at the aggregate paste interface because they are disseminated throughout the concrete.

• This research investigates the effect of polypropylene fiber on concrete mix when replacement of cement is done with marble dust. The percentage of replacement of cement with marble dust has been kept constant that is 10% by weight and the proportion of Polypropylene fiber are varied in the percentage of 0%, 0.5%,1.0%,1.5% and 2.0%.

• The use of polypropylene fiber Concrete has been the subject of numerous investigations. The majority of the research focuses on improving the physical and mechanical qualities of concrete. Chemical assault is the main cause of corrosion in hardened concrete, hence polypropylene fiber reinforced concrete has been detected in experimental research. It can also be utilized for dynamic structures after improving its tensile strength.

• It can replace mechanically compacted concrete after boosting its tensile and flexural strength.

• If polypropylene fiber aggregate proves to be effective in boosting concrete strength, it might be used in place of fine aggregate rather than recycling, which is not cost-effective.

• The economic comparison of PPF reinforced concrete with various additions such as marble dust, fly ash, furnace slag, and so on has a lot of room for improvement.

• Concrete can be utilized in heavy structures such as bridges, dams, and foundation construction after it has been strengthened.

• Similarly, as concrete's strength improves, it can be used for prefabricated constructions.

• PPF reinforced concrete can also be used in rigid pavement for impact load resistance on expressways and roads, where military tanks and planes can land. Polypropylene fiber in concrete is widely utilized in the construction of concrete frames, making it one of the most important application areas in the worldwide fiber industry. The demand from the segment will continue to rise as the concrete industry grows in the process of designing and building in-situ frame buildings. Following are some scope in polypropylene fiber concrete having marble dust:

• Polypropylene fibers make concrete lightweight, making it ideal for use in precast concrete blocks.

• PPF is also used in the production of corrosion-resistant concrete, which makes it more durable.

• Marble dust is used as a concrete cost optimizer since it minimizes the amount of cement used.

• There is a lot of research potential in concrete with marble dust and polypropylene fiber, as well as other additions, to build a concrete that is strong, durable, and cost-effective.

1.2 Objectives of Study

- Partial replacement of cement with dust which is from marble and to add polypropylene fiber to increase the different strengths like compressive, tensile, flexural and workability etc. of the concrete.
- To reduce the cracks which are developed because of plastic shrinkage.
- To increase the different strengths of concrete using polypropylene fiber.
- To reduce the damage occurred by liquefying, subfreezing and fire in concrete.
- To decrease the failure of impact load and to provide proper resistance in concrete.
- To analyze the workability of fresh concrete.

1.3 Advantages and Disadvantages

1.3.1Advantages:

PPF increases toughness and compressive strength when it has high elastic modulus and stiffness. Further, there are so many merits of using polypropylene fiber are:

- Increases fatigue, impact and resistance towards absorption.
- It increases tensile, flexural strength, increases ductility of concrete, also provide resistance towards the spreading of cracks and ability to resist load.
- Research is needed to establish the long-term Durability of Concrete containing polypropylene fiber.
- Concrete's microstructure qualities can be investigated.
- Adding chemical admixtures to boost the workability of polypropylene fiber concrete can be investigated further. PPF is chemically resistant, which improves the structure's overall function.
- The hydrophobic surface is resistant to balling because it is not influenced by cement paste.
- Because polypropylene fiber has no water requirement, there is no need to raise the water content of concrete.

- Because of its high elongation of 15 to 20%, PPF is a low modulus fiber that imparts increased energy absorption.
- PPF and marble dust boost the different characteristics like compressive, split tensile and flexural strength of concrete.
- PPF increases resistance to impact load, cracking, freezing, and thawing effects, among other things.
- Polypropylene fiber is a light-weight fiber that does not add to the structure's dead load and maintains structural components light and thin. As PPF, The following are some of the benefits of using marble dust in concrete:
- Marble dust is a waste material that is used in concrete instead of cement in a small amount, lowering the cost of the concrete and making it more cost effective.
- By filling the spaces in concrete, marble dust improves its strength properties.

1.3.2 Disadvantages:

Some of disadvantages of PPF and marble dust in concrete are as given below-

- Because PPF reinforced concrete is more expensive, it can't be used for everyday building.
- PPF has a negligible effect on the flexural strength of concrete hence it cannot be used to substitute structural steel reinforcement, which aids in the structure's moment resistance.
- PPF lowers the workability of concrete after a certain amount.
- Concrete with polypropylene fiber and marble dust necessitates careful planning, mixing, and placement, which necessitates additional skill.
- After a certain limit marble dust reduces the strength of concrete

II. LITERATURE REVIEW

- Yeswanth et al., (2016) with the inclusion of fibers and fly ash, the effect of polypropylene fiber on concrete was tested. Different amounts of fiber (0%, 0.05 %, 0.1 %, 0.15 %, 0.2 %, 0.25 %, 0.30 %, 0.35 %, 0.40 %) were added to the volume of concrete, while different amounts of fly ash (0 percent, 10%, 20%, 30%, and 40%) were added to the volume of cement. The addition of PPF to concrete containing fly ash has been found to have a minor negative effect on the workability of the concrete; however, the addition of PPF and fly ash increase the strength of hardened concrete. In comparison to other concrete composites without fiber and fly ash, there was also an increase in cracking resistance.
- Verma et al., (2015) The influence of polypropylene fibers ranging from 0.1% to 0.4 %, as well as 0.8 % steel fibers, on the stress-strain behavior of fibrous concrete is investigated. The results show that adding polypropylene fiber reduces the failure strain as the volume percent of polypropylene fiber increases. According to the research, polypropylene fibers with a larger percentage of polypropylene fiber have a better toughness
- Pansuriya1 and Shinkar (2016) By adding polypropylene fibers to the mix at 0.5 %, 1 %, 1.5 %, 2 %, and 2.5 % by weight of cement added to the mix, the mechanical properties of M30 grade concrete can be investigated. A comparison of regular concrete to fiber reinforced concrete in terms of compressive, tensile, and flexural strengths has been carried out for the purposes of the analysis. In comparison to typical bituminous asphalts, cement is becoming a more appealing choice for base venture due to growing oil costs and a tighter monetary climate. India's Ministry of Road Transport and Highways has recognized that a modern civilization cannot function effectively without concrete roadways. Cement has a number of flaws, including poor tensile strength, a short fatigue life, and brittle failure, which results in a near-complete loss of loading capacity once failure occurs.
- Rani and Priyanka (2017) conducted an experimental investigation employing polypropylene fiber to investigate the behavior of mechanical properties of self-compacting concrete, including compressive and flexural strength. There was also a comparison of polypropylene fibers and traditional fibers. According to the findings, the maximum amount of fiber in SCC was 0.75 percent to 1% of the total cement content per mix.

III. MATERIALS AND METHODOLOGY

3.1 CEMENT

Cement is made by burning a mixture of calcareous and argillaceous minerals at a very high temperature. The proportions of the elements should be right and the mixture should be intimate.

When cement is mixed with water, it takes a while to become hard. This is referred to as cement settling. To manage the setting process of Portland cement, gypsum is used. It functions as a retarder, allowing cement to be combined with aggregates and put.

Grades of Cement

OPC cement is divided into three categories based on the strength of the cement after 28 days when tested according to IS 4031-1988.

- 33 Grade OPC (IS: 269-1998): After 28 days, the minimum compressive strength is 33 N/mm2.
- 43 Grade OPC (IS: 8112-2000): After 28 days, the minimum compressive strength is 43 N/mm2.
- 53 Grade OPC (IS: 12269-1999): After 28 days, the minimum compressive strength is 53 N/mm2

❖ Ingredient OPC	Range of Percentage
CaO	60 – 67
SiO_2	17 – 25
Al_2O_3	3.0-8.0
Fe_2O_3	0.5-6.0
MgO	0.1-4.0

TABLE NO: 1 CEMENT COMPOSITION

Physical properties of cement :

3.3 POLYPROPYLENE FIBRE

Polypropylene Fiber Polypropylene is made from monomeric C3H6, a completely hydrocarbon compound. As mentioned below, the characteristic of polypropylene fibers is quite useful:

- The hydrophobic surface, which is not moistened by cement paste, prevents chopped fibers from balling up during mixing, as it does with other fibers.
- Polypropylene fibers have no water requirements.
- Because of the orientation, the film is weak in the lateral direction, allowing fibrillations to form. As a result, the cement matrix can penetrate the mesh structure between individual fibrils, forming a mechanical link between the matrix and the fiber.

PPF comes in a variety of forms, including fibrillated bundles, mono filaments, and microfilaments. The fibrillated PF are made by stretching a plastic film that is then cut into strips and sliced. The insertion of buttons to the ends of monofilament fibers improves the pull out load. Polypropylene fibers are made from a synthetic resin made from propylene polymerization. Toughness, flexibility, light weight, and heat resistance are all advantages of polypropylene.

FIG NO: 1.POLYPROPYLENE FIBRE

3.4 MARBLE DUST

Marble is a metamorphic rock made up mostly of recrystallized carbonate minerals like calcite and dolomite. Marble can have foliation. Marble is a metamorphic rock formed when limestone is heated and compressed during metamorphism. It is largely made up of the mineral calcite (CaCO3), but it may also contain clay minerals, micas, quartz, pyrite, iron oxides, and graphite. Calcite in limestone recrystallized during metamorphism, resulting in a rock that is a mass of interconnecting calcite crystals. When dolostone is heated and compressed, a related rock called dolomitic marble is formed.

FIG NO: 2: MARBLE DUST

PREPARATION OF MATERIALS

The cement was kept in airtight metal canisters in a dry location. Each batch had aggregate samples that were of the desired grading and had been air-dried. All of the materials must be collected in the proper quantity prior to mixing.

• Weighing

Each batch's cement, aggregate, and water quantities were calculated by weight, with an accuracy of 0.1 percent of the overall batch weight. By weight of cement, marble dust and PPF were taken.

• Mixing

Using a shovel, trowel, or other suitable equipment, the concrete batch was mixed on a water-tight, non-absorbent platform as follows: The cement, marble dust, polypropylene fiber and fine aggregate were combined dry until the color was consistent and the mixture was well blended. After that, the coarse aggregate was added and mixed with the cement and fine aggregate until the coarse aggregate was evenly distributed throughout the batch, and then the water was added and the entire batch was mixed until the concrete seemed to be homogeneous and had the appropriate consistency. Due to the addition of water growths while changing the consistency, the batch was abandoned and a new batch was prepared without halting the mixing process.

FIG NO: 3: CONCRETE MIXER

• PREPARATION OF SPECIMEN

[1] Compressive strength: cube

The cube mould was instantly filled when the sample was evenly mixed. Any trapped air in the concrete would lower the cube's strength. As a result, the cubes were completely crushed. It was also taken care not to over compact the concrete, as this could have resulted in aggregate and cement paste segregation in the mix. It's also possible that it'll lower the final compressive strength. The cubes were 150x150x150 mm in size.

FIG NO: 4: CONCRETE CUBES

[2] Split tensile strength: Cylinder

The cylinder mould was immediately filled when the sample was mixed. Any trapped air in the concrete would lower the cylinder's strength. As a result, the cubes were completely crushed. It was also taken care not to over compact the concrete, as this could have resulted in aggregate and cement paste segregation in the mix. It may also weaken the final product. The cylinders were 150 mm (dia.) and 300 mm (dia.) in diameter (length).

FIG NO: 5: CONCRETE CYLINDERS

[3] Flexure strength : Beam

The beam mould was instantly filled after the sample had been evenly mixed. Any trapped air in the concrete would lower the beam's strength. As a result, the cubes were completely crushed. It may also weaken the final product. The beams were 150x150x500 mm in size.

FIG NO: 6: CONCRETE BEAMS

• De-moulding & Curing of Concrete

After 24 hours, the test specimens were de-molded. For 24 hours and 12 hours after adding water to the dry components, test specimens were stored in a vibration-free environment with at least 90% relative humidity and at a temperature of 270 2 0C. After this time, the specimens were tagged and removed from the moulds, and unless the test was necessary within 24 hours, they were immediately submerged in clean fresh water and maintained there for 14 and 28 days, respectively, to cure before being tested. Every seven days, the water or solution in which the specimens were submerged was replaced, and the temperature was kept at 27º ± 2 ºC. The specimens were not allowed to dry out until they were ready to be used.

FIG NO: 7: MOULDS

IV. PROPERTIES AND TESTS

a Fineness Test

• Take a sample in a dish and put it in the oven at a temperature of 1000 – 1100C. After drying take known amount of the sample and note down as W.

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• Arrange the sieves in ascending order, starting with the largest sieve at the top. If using a mechanical shaker, place the ordered sieves in place, pour the sample into the top sieve, and close it with the sieve plate. The machine should then be turned on and the sieves should be shaken for at least 15 minutes.

• If shaking by hand, pour the sample into the top sieve and shut it, then shake it inwards and outwards, vertically and horizontally, holding the top two sieves.

• Record the sample weights maintained on each sieve after sifting. Then calculate the total weight retained. Finally, calculate the total percentage of each sieve that has been retained. We may calculate the fineness modulus by adding all of the cumulative percentage values and dividing by 100.

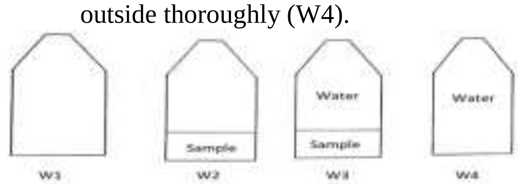
TABLE NO: 3 SEIVE ANALYSIS

S.NO	MATERIAL	SIEVE SIZE	FINENESS MODULUS
1	Cement	90 micron sieve	93%
2	Sand	>4.75mm to 0.15mm	27.5%
3	Marble dust	>4.75mm to 0.15mm	24.4%

b Specific Gravity Test

Fine Aggregates (Sand, Cement and Marble Dust)

- Dry the pycnometer and weigh it with its cap (W1)
- Take about 200gm to 300gm of oven dried soil passing through 4.75mm sieve into the pycnometer and weigh again (W2)
- Add water to cover the soil and screw on the cap.
- Shake the pycnometer well and connect it to the vacuum pump to remove entrapped air for about 10 to 20 minutes.
- After the air has been removed, fill the pycnometer with water and weigh it (W3).
- Clean the pycnometer by washing thoroughly.
- Fill the cleaned pycnometer completely with water up to its top with cap screw on.
- Weigh the pycnometer after drying it on the outside thoroughly (W4).



Coarse Aggregates

- Approximately 2kg of aggregate is washed thoroughly to remove particles, drained, and then placed in the wire basket and immersed in distilled water at a temperature of 22 to 320C with a cover of at least 50 mm of water above the top of the basket.
- Immediately after the immersion the entrapped air is removed from the sample by lifting the basket containing it 25 mm above the base of the tank and allowing it to drop 25 times at the rate of about one drop per second. The basket and the aggregate should remain completely immersed in water for a period of 24±0.5 hours afterwards.
- The basket and sample are then weighed while suspended in water at 220 to 320 degrees Celsius. While suspended in water, the weight (W1) g is recorded.
- The aggregates are then transferred to the dry cloth once the sample and basket are taken out from the water and allowed it to drain for a few minutes.
- Return the empty basket to the tank, shook it 25 times, and the weights in water (W2) g are calculated.
- The aggregates which are placed on the absorbent cloth will be completely dried and to check that the cloth can no longer absorb any more moisture.
- Then the aggregate is transferred to the second dry cloth spread in a single layer, covered and allowed to dry for at least 10 minutes until the aggregates are completely surface dry. 10 to 60 minutes drying may be needed. The surface dried aggregate is then weighed (W3) g.
- The aggregate is placed in a shallow tray or pan and baked for 24 hours at 1100˚C in an oven. After that, it is taken out of the oven, chilled in an airtight container, and weighed (W4) g.

TABLE NO: 04 SPECIFIC GRAVITY OF MATERIALS

S.No.	Material	Equipment	Reference Standard Liquid	W1g	W2g	W3g	W4g	G
1	Cement	Pycnometer	Kerosene (0.79)	622	942	1502	1310	3.1045
2	Sand		Water	622	1076	1783	1498	2.66
3	MD		Water	622	1238	1896	1506	2.77
4	Coarse Aggregates	Wire basket	Water	2000	697	1990	1006	2.76

C Water Absorption Test

- Take known amount of sample , oven dry it by maintaining 1100C of temperature for 24 hours
- Now allow the sample to cool down at room temperature.
- After cooling weight, the sample as WA.
- Now emerge the sample in water for 24 hours at 230C.
- Remove the sample, pat it dry with cotton cloth and weight the sample as WB
- Use below mention formula to calculate the amount of water absorb by the sample.

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- Water Absorption = (Wa – Wb)/Wb * 100

TABLE NO: 05 WATER ABSORPTION OF MATERIALS

S.No	Material	Wag	Wbg	WA %
1	Course Aggregate	1005.025	1000	0.5
2	Fine Aggregate	252.48	250	1
3	Marble Dust	504.92	500	1

V. RESULT

Workability of Concrete

1. SLUMP TEST

S. No.	Control Mix	Slump (mm)
1	M25	75
2	M30	90

SLUMP WITH 10% MARBLE DUST POWDER AND POLYPROPYLENE FIBRE

Polypropylene Fibre %	Compressive Strength(N/mm²)		
	7 Days	14 Days	28 Days
0.0	16.09	21.46	26.82
0.5	17.05	23.78	29.93
1.0	20.52	26.94	33.64
1.5	21.24	27.85	34.82
2.0	18.17	22.24	27.70

slump comparison for different fiber content % It has been noticed that when the amount of polypropylene fiber in concrete grows, the slump of the concrete reduces, and hence the workability diminishes. As a result, concrete with 0% fiber has the best workability, whereas concrete with 2.0% fiber has the worst.

2. COMPRESSIVE STRENGTH TEST

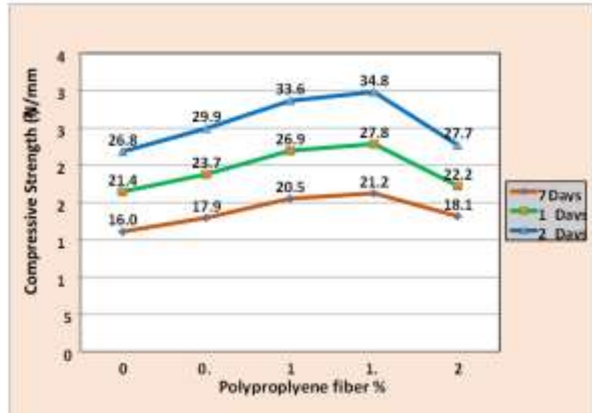
Concrete's compressive strength is its most important attribute. Cubes with dimensions of 150x150x150 mm were cast and tested on compression testing equipment for compressive strength.

Polypropylene Fiber %	Compressive Strength(N/mm²)		
	7 Days	14 Days	28 Days
0.0	19.60	26.50	32.67
0.5	20.41	26.12	33.47
1.0	21.50	28.46	35.84
1.5	22.80	29.47	36.79
2.0	21.71	28.76	35.60

• M25 GRADE CONCRETE

TABLE NO: 8 COMPRESSIVE STRENGHT FOR M25 GRADE CONCRETE

GRAPH NO: 01



Graph no 01 shows that for both 14 and 28 day curing periods, the minimal compressive strength was obtained at 0% addition of polypropylene fiber, while the optimal compressive strength was obtained at 1.5 percent addition of polypropylene fiber.

It was also discovered that the ideal percentage increase in concrete compressive strength was 12.61 percent after 28 days of curing.

• M30 GRADE CONCRETE

TABLE N0: 09 COMPRESSIVE STRENGTH OF M30 GRADE CONCRETE

Polypropylene Fiber %	Compressive Strength(N/mm²)		
	7 Days	14 Days	28 Days
0.0	19.60	26.50	32.67
0.5	20.41	26.12	33.47
1.0	21.50	28.46	35.84
1.5	22.80	29.47	36.79
2.0	21.71	28.76	35.60

GRAPH NO 02

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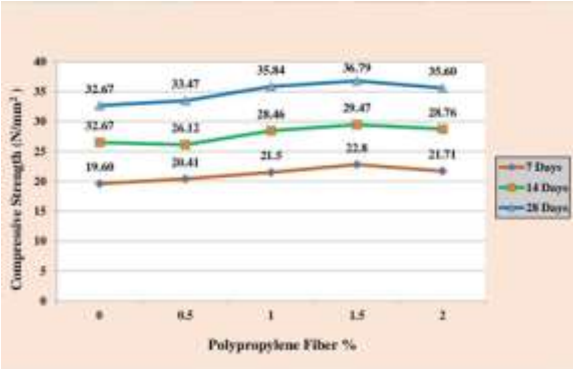

VI. CONCLUSION

M20 GRADE CONCRETE

1. Compressive Strength:

After 1.5 percent of PPF compressive strength drops for both 14 days and 28 days cube strength, the compressive strength grew as the percentage (percent) of polypropylene fiber (0 percent to 1.5 percent) increased. The ideal percentage increase in concrete compressive strength was found to be 29.82 percent after 28 days of curing.

2. Split Tensile Strength:

At 14 and 28 days of curing, the least split tensile strength was obtained with 0% polypropylene fiber addition, while the maximum split tensile strength was obtained with 1.5 percent polypropylene fiber addition.

The ideal percentage increase in split tensile strength of concrete was found to be 45.53 percent after 28 days of curing.

3. Flexure Strength:

At 14 and 28 days of curing, it was shown that the flexural strength of concrete increased gradually with the addition of polypropylene fiber, with the lowest flexural strength obtained at 0% and the highest flexural strength acquired at 1.5 percent addition of polypropylene fiber. The ideal percentage increase in flexural strength of concrete was found to be 30.76 percent after 28 days of curing.

4. Durability:

It was concluded that the percent loss of weight of cube specimens for resistance against acid attack was found to be –

- For MD 10% at 28 days - 0.92 %
- For MD 10% and PF 0.5% to 2.0% at 28 days found increasing - 0.95 to 1.73 %

The results revealed that the percent loss of weight of cube specimens for resistance against alkali attack was found to be –

- For MD 10% at 28 days - 0.26%
- For MD 10% and PF 0.5% to 2.0% at 28 days found increasing - 0.31 to 0.51 %.

M30 GRADE CONCRETE

1. Compressive Strength:

For both 14 and 28 days curing periods of cubes, the results demonstrated that minimal compressive strength was obtained at 0% addition of polypropylene fiber and optimal compressive strength was obtained at 1.5 percent addition of polypropylene fiber.

The ideal percentage increase in concrete compressive strength was found to be 12.61 percent after 28 days of curing.

2. Split Tensile Strength:

At 14 and 28 days of curing, the results demonstrated that a 0% addition of polypropylene fiber resulted in the lowest split tensile strength, while a 1.0 percent addition of polypropylene fiber resulted in the highest split tensile strength.

The ideal percentage increase in split tensile strength of concrete was found to be 23.72 percent after 28 days of curing.

3. Flexure Strength:

At 14 and 28 days of curing, the minimum flexural strength was obtained at 0% addition of polypropylene fiber, whereas the maximum flexural strength was reached at 1.0 percent addition of polypropylene fiber.

The ideal percentage increase in flexural strength of concrete was found to be 25.18 percent after 28 days of curing.

4. Durability:

It was concluded that the percent loss of weight of cube specimens for resistance against acid attack was found to be –

- For MD 10% at 28 days - 96%
- For MD 10% and PF 0.5% to 2.0% at 28 days found increasing - 1.09 to 1.89%

The results revealed that the percent loss of weight of cube specimens for resistance against alkali attack was found to be –

- For MD 10% at 28 days - 0.37%
- For MD 10% and PF 0.5% to 2.0% at 28 days found increasing - 0.48 to 0.77%

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