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PERFORMANCE ON BANANA FIBRE CONCRETE BY PARTIAL REPLACEMENT OF CEMENT WITH MARBLE DUST POWDER BY USING M_{30} GRADE

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Abstract: Marble powder is pollution in modern times. In order to prevent emissions to a great extent, we are suggesting a solution that includes partially substituting cement with marble powder. Humanity is seriously threatened by global warming. Replacement of non-renewable, non-degradable, and synthetic materials with renewable, biodegradable, and natural materials is necessary to halt and reverse the effects of global warming. Utilizing or coming up with creative uses for agricultural waste that may be used in banana trunks is the best method to effect change. Pipe stems can be used to extract fibre, which is widely used in the textile, paper, and composite materials industries. Banana fibre is an excellent substitute for synthetic fibre. The building material marble is frequently employed. Why? Because it is a byproduct of the marble industry, which has negative consequences on both the environment and human health. By reducing these effects, we can conserve natural resources. With banana fibre added as an additive, cement can be substituted with marble dust powder in the following percentages: 0%, 5%, 10%, 15%, 20%, and 25%. By these percentages, the maximum compressive strength and split tensile strength of concrete at ages 7 and 28 days both rise by 15%.

Keywords: Compressive strength; marble powder; Banana fibre Split tensile strength.

1. INTRODUCTION

Concrete is one of the most used building materials. Ton for tonne, its global utilisation exceeds that of steel, wood, polymers, and aluminium combined. Globally, the ready-mixed concrete industry. The mix consistency is fluid and uniform, allowing it to be poured into moulds rather than hand-layering with placelkent of aggregate. The most common type of concrete binder is cement, most typically Portland cement. Water is combined with the dry powder and aggregate in cementitious binders. The concrete solidifies and hardens due to a chemical process known as hydration. Admixtures are used to change the cure rate or the characteristics of the material. The effective use of marble dust as cement would transform this waste material that creates disposal issues into a profitable resource. Using this material has various benefits, including better mechanical and stiffness qualities, as well as environmental benefits connected to waste disposal and carbon dioxide reduction in emissions. In the past, banana fibre was used largely to make ropes, carpets, and other composite materials.With increased environmental consciousness and the importance of eco-friendly materials, banana fibre has been recognized for all of its beneficial properties, and its application in other industries such as construction project is expanding. The exploration of the traditional method of weaving banana cloth using filaments yarns. The discovery revealed that the convention procedure was time-consuming and so unsuitable for modern use. As a result, this study looked into the open-ended spinning process for yarn development. For the mixing process, the fibre was chopped into 3-4 centimeters lengths.

2. OBJECTIVES

a) The primary objective of this study is to investigate the effect of partially replacing cement with marble dust powder and compare it to the compressive strength of M30 grade.

b) We are also attempting to determine the amounts of marble dust powder substituted in concrete that improve concrete strength.

c) We are developing a method that has the potential to significantly reduce pollution.

3. MATERIALS

3.1 Cement

The cement used was Ordinary Portland Cement 53 and presented in table 1.

Table 1.Characteristics of Cement and Tested Values

S.No	Test	Result	Specified by (IS:455)
1	Fineness	265	225
2	Consistency	30.42	30
3	Initial setting time(min)	45	30
4	Final setting time(min)	435	600
5	Specific gravity	2.695	2.5-3.5
6	Compressive strength(N/mm^2)	37.49	33
7	Soundness	9.75	10

3.2 fine aggregate

Fine aggregate is defined as rock particles having a diameter of less than 4.75mm, which are commonly referred to as sand. The obtained bulk density of fine and coarse values is 1520-1680kg/m3. The specific gravity is 2.649.

3.3 coarse aggregate

Coarse aggregate is defined as any particle larger than 0.19 inch but often ranging between. The specific gravity is 2.892. Water absorption should not exceed 0.6 per unit weight.

3.4 Marble dust

Marble dust powder is a metamorphic rock made up of recrystallized carbonate minerals such as calcite or dolomite. Marble can have foliation. The term "marble" is used by geologists to refer to metamorphic rocks lime; however, construction workers use the term more widely to include un-metamorphosed limestone. Marble is a popular sculptural material as well as a construction material.

Table 2:- Physical properties of marble dust powder

S.No.	Parameter	value
1	Fineness modulus	2.01
2	Bulk density(kg/m^3)	1093
3	Specific gravity	2.72

Table-3:- Chemical properties of marble dust powder

Oxides	Content percentage
Sio_2	0.69
Al_2O_3	0.37
Fe_2O_3	0.11
Cao	53.92
MgO	0.245
SO_3	0.19
Na_2O	0.09
K_2O	0.029
Cl	0.07
Sr0	0.048
L.O.I	42.91
Total	98.672
Humidity	0.502
Water content	23.495

3.5 Banana fibre

The banana or bananas plant not only produces delicious fruit but also textile fibre, known as banana fibre. Fibre is banana fibre. Fibre, a ligno-cellulosic fibre derived from the pseudo-stem of the banana plant (Musa sepientum), is a thickest fibre with high mechanical qualities.

Characteristics of banana fibre:

1) Banana fibre has a similar appearance to bamboo fibre and merino fibre, but it is finer and spinnable than the other two.
2) Banana fibre is composed of cellulose, hemicellulose, and lignin.
3) It is a very strong fibre.
4) It has an average fineness of 2400N-m.

Properties of Banana Fibres:

Table-4:- Properties of Banana Fibres

Tenacity	29.98 g/denier
Fineness	17.15
Moisture Regain	13.00%
Elongation	6.54
Alco-ben Extractives	1.70%
Total Cellulose	81.80%
Alpha Cellulose	61.50%
Residual Gum	41.90%
Lignin	15.00%

4. RESULTS

4.1Compressive strength:

The compressive strength test was conducted on various ages 28,56 and 90 days.

Table-4:- Compressive strength results of partial replacement of cement with marble dust powder

% of marble dust powder	% of Banana fibre	28 days(N/mm^2)	56 days(N/mm^2)	90 days(N/mm^2)
0%	0%	41.80	45.26	48.86
5%	1%	46.76	50.92	54.65
10%	2%	53.94	58.76	62.61
15%	3%	61.46	67.15	71.90
20%	4%	59.12	62.39	69.01
25%	5%	54.14	58.91	63.24

Table -5:- Split strength test results of partial replacement of cement with marble dust powder

% of marble dust powder	% of Banana fibre	28 days (N/mm^2)	56 days (N/mm^2)	90 days (N/mm^2)
0%	0%	4.10	4.46	4.79
5%	1%	4.47	4.86	5.22
10%	2%	5.30	5.77	6.19
15%	3%	6.12	6.66	7.14
20%	4%	5.45	5.93	6.37
25%	5%	5.02	5.46	5.88

5. CONCLUSIONS

1. The 28,56 and 90 days compressive strength of banana fibre concrete at Normal concrete is 41.80 N/mm^2, 45.26 N/mm^2, 48.86 N/mm^2.
2. The 28,56 and 90 days split tensile strength of banana fibre concrete at Normal concrete is 4.10 N/mm^2, 4.46 N/mm^2, 4.79 N/mm^2.
3. The 28,56 and 90 days compressive strength of banana fibre concrete at 15%MDP+3%BF is 61.46 N/mm^2, 67.15N/mm^2, 71.90 N/mm^2.
4. The 28,56 and 90 days split tensile strength of banana fibre concrete at 15%MDP+3%BF is 6.12 N/mm^2, 6.66 N/mm^2,7.14 N/mm^2.

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