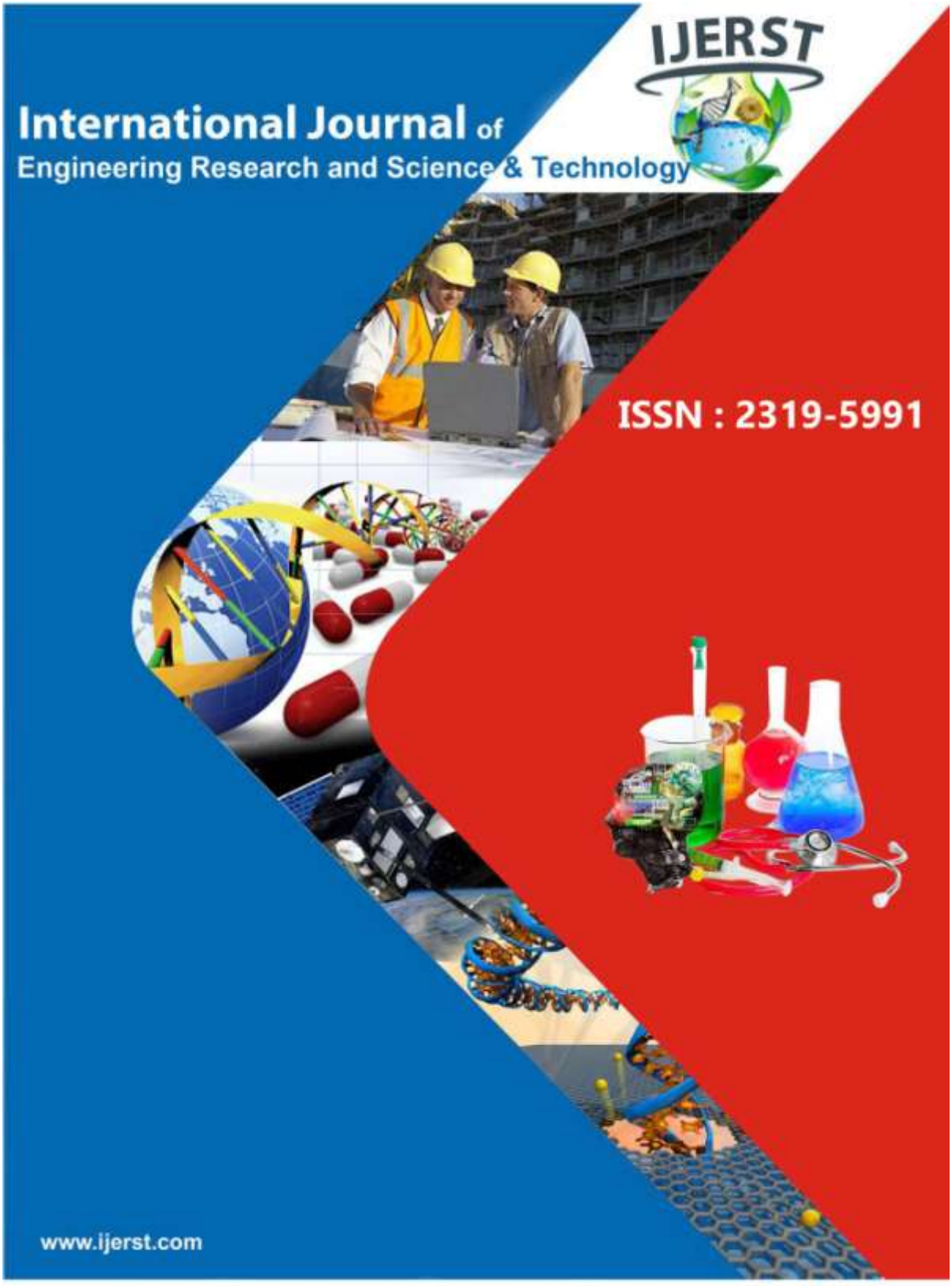

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EVALUTION OF STRENGTH PARAMETERS ON PARTIAL REPLACEMENT OF CEMENT WITH DOLOMITE POWDER & FINE AGGREGATE WITH SUGARCANE BAGGASE ASH

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Abstract: The purpose of this experiment is, to raise the strength of the M30 grade concrete mix. The compressive strength, split tensile strength and flexure strength shall be compared with those of the reference specimen and this paper inspects the possible results of using dolomite powder in partial replacement of cement and sugarcane bagasse ash in replacement of fine aggregate. Dolomite powder is acquired by grinding the sedimentary rock and it is preferred as the constructional material because of its higher density, for producing cement with dolomite powder, finely grounded dolomite was used as the cementatious material and in this experiment the partial replacement percentage of dolomite is 0%, 5%, 7.5%, 10%, 15%.

The recent researches are experiencing agricultural and industrial wastes as a source of raw materials for the construction & the utilization of waste would be economical. Sugarcane baggase has been classified as the fibrous waste outcome from sugarcane in Sugar refining Industries. In this evaluation, sugarcane bagasse ash is partially replaced with fine aggregate and the percentages are 0%, 10%, 20%, 30% and 40%. This bagasse ash mainly contains aluminium and silica. By the both combinations of Dolomite powder and SCBA we have got the good results up to 5% ,10% replacements. Flexural strength decreases with the increasing of dolomite powder percentages.

Keywords:; M30 grade concrete; Sugarcane Bagasse Ash; Dolomite powder; Compressive Strength; Split Tensile Strength; Flexural Strength.

1. **Introduction**:

Concrete: In the majority of the structural buildings, concrete is the basic building material which is utilized. Its noticeable quality as significant building material in development is a result of its economy of utilization, great durability and strength with which it can be made at site. With coming of new age admixtures, it is viable to acquire higher assessments of cement accompanied by high workability levels. In concrete using admixtures like fly ash, silica and metakaolin, the workability and strength of concrete are transformed into various forms. In anycase when the mix design was adopted, it ought to be implemented on site without any miscalculation.

Dolomite Powder: Dolomite is a carbonate material made out of calcium magnesium carbonate

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CaMg(CO3)2. It is a rock forming mineral. Dolomite has a proper weathering opposition. It can be used as cementatious material. Preethi and Prince Arulraj (2015) has done the dolomite powder replacement in cement and they noticed that the strength of the

concrete has been raised, they replaced 10% of cement accompanied by dolomite powder & on 28th day for this level of replacement, 10.4 & 17.8 are the maximum raise in percentages of compressive strength and flexural strength were observed respectively. For 15% of replacement in cement with dolomite powder, 39.8% is the range of increase has been observed for spilt tensile strength test.

Sugarcane Bagasse Ash: Sugarcane is a massive harvests and were produced in 110 countries, its complete production range is of 1500 million ton. In India, sugarcane production is of 300million tons/year. On that reason, around 10 million ton of bagasse searing stays as un used and misspend material. After the extrication of sugar from sugarcane, 40-45% fibrous content was obtained, the content can be reused in industry as fuel in boilers for warm age betraying, 8 - 10% burned ash will remain as waste which is perceived as sugarcane bagasse ash (SCBA). Aluminum, silica and calcium oxides were the unburt matter of SCBA. The ash, thusly, transforms into an advanced waste. Few investigations are examined in past, on bagasse ash utilization. Prashant O Modani and M R Vyawahare (2012) stated that, with the 10 & 20 percent replacement mix of bagasse ash, the compressive strength result increased for 28days when compared to 7 days strength result and that might be due to pozzolanic properties of bagasse ash. Sorpivity percentage has been increased by increasing the percentage of baggase ash ,which shows more permeable concrete that is due to porous nature of sugarcane bagasse ash & the impurities in it. Malyadri and J.Supriya(2015) has investigated that by reducing the utilization of cement we can perceive that the strength of the concrete has increased when sugar cane bagasse ash is partially replaced with cement in concrete. Objectives of this experiment is to design and produce mix proportions for conventional concrete, to evaluate the physical properties and chemical properties of dolomite powder and SCBA. In this project, admixtures such as dolomite powder in replacement of cement and SCBA in replacement of fine aggregate are used to gain the strength of concrete.

2.Materials: Materials used in experiment and their properties are :

Cement: Normal ordinary portland cement of 53 grade. Its specific gravity 3.12.

Coarse Aggregate: Locally available broken rocks were used. The size of rocks are 10mm and 12mm were used in the experiment.

Fine aggregate: IS sieve of size 4.75 passing, locally available sand was used.

Water: Locally available drinking water was used in the experiment.

Dolomite: Dolomite is opted as construction material due its surface indentation and abrasion. Calcium content is high in dolomite powder i.e.,48.02%. Physical & chemical properties of dolomite powder are stated in table 1 & 2 respectively.

Table 1: Physical properties of dolomite

Chemical Classification	Calcium magnesium Carbonate
Specific Gravity	2.8 to 2.9
Chemical Composition	$CaMg(CO_3)_2$
Used as	Construction Material, For manufacturing cement,used in construction of oil and gas reservoir, agricultural soil treatments.

Table 2: Chemical properties of dolomite powder

Particulars	Percentages by mass
SiO2	11.65%
Al2O3	1.20%
Fe2O3	0.47%
CaO	48.02%
K2O	0.01%
MgO	0.06%
SO3	0.44%
Loss ofIgnition	37.56%

Figure 1 : Dolomite powder

Sugarcane bagasse Ash (SCBA) : Sugarcane bagasse is the immense

result from sugar

production industries after the juice is extricated from the cane. In anycase, it is used as a fuel

to fire furnaces in factories that left over contains about 8-10% ashes containing high contents of Chemical mass (Chemical mass percentages are specified in Table3, respectively), silica content is more in SCBA i.e, 70.94%. The crumb was made into ash form & will be taken

industrial waste and poses disposal problems. For obtaining formless and well disposed

sugarcane bagasse ash (SCBA), several trials were performed to define flaming time and

temperatures. SCBA utilized as a part of this investigation was gotten by consuming SCB at 600o C for 5 hours.

Table 3 : Chemical compostion

Particulars	Percentages by mass
SiO_2	70.94%
Al_2O_3	1.49%

Fe_2O_3	2.01%
CaO	3.66%
K_2O	1.92%
Mg O	2.93%
SO_3	1.48%
Loss of Ignition	15.84%

Figure 2 : Sugarcane bagasse ash

4. Methodology:

Mix Design: Mix design of M 30 grade concrete Number of cubes = 9

Dimension of cube = 0.003375 m3 Total volume of cube = 9*0.003375 Volume of 2 cylinders = 0.01059 m3 Flexure strength = l b h

= 15 * 15 * 70

= 0.15 * 0.15 * 0.70

= 0.01575 m3

Total volume = 0.030 + 0.01058 + 0.01575 = 0. 05633m3

Target Strength Mix Proportions :

ft = fck + 1.65*S Where,

ft = Target mean strength

fck = Characteristic compressive strength

S = Assumed standard deviation in N/mm2 = 5 (as per table IS 10262- 2009)

= 30 + 1.65 * 5 = 38.25 N/mm2.

Selection of water-cement ratio:

Maximum w/c ratio = 0.45 (From table 5 of IS 456) Selection of water content

Maximum water content for 20 mm aggregate = 186 Kg (for 25 to 50 slump) Estimated water content for 100 Slump = 205+ (6/100) X 186 = 217.347litres

Water content = 217.347 liters Water Content = 217.3 kg / m3 217.3/ C = 0.50

C = ?

C = 434.6 kg

Aggregate FA – 40% , CA- 60%

Volume of cement = (Wt of cement)/(Sp.Gr)*1/1000

= 434.6/3.15*1/1000

= 0.137m3

Volume of cement = (Wt of water)/(Sp.Gr)* 1/1000

= 217.3/1*1/1000= 0.2173m3

Total volume of aggregate = 1- (volume of cement + volume of water) = 1- (0.137+ 0.217)

= 0.646m3

Mass of course aggregate = Total volume x Sp.Gr x 1000

= 0.646 x 0.60 x 2.74 x 1000= 708.016 kg

= 434.6 : 708.01 : 1062.0 = 1:1.6:2.44

Figure 6

Concrete Mix proportions for Trial Number

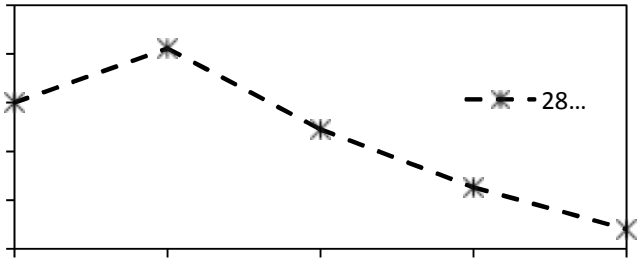
Cement : 434.6kg/m3 Water : 217.3 kg/m3

Fine aggregates : 708.01kg/m3 Coarse aggregate : 1062.02 kg/m3 Water-cement ratio: 0.5

6.Tests and Results: Compressive Strength:

By this we can say that the combination of the both Dp & SCBA has low strengths, after crossing the certain amount of combination percentage. 7.5% of Dp & 20% of SCBA has reached the target mean strength & the combination of 5% of Dp & 0% of SCBA has crossed the target mean strength. The combination of 10% of Dp , 30% of SCBA & 15 % of Dp , 40% of SCBA has acquired low grade strength.

Split Tensile Strength Test:



Dolomite powder percentages

Figure 10 : Split tensile strength test graph of dolomite powder

From the above fig, The Split Tensile strength of concrete till 7.5% of Dolomite powder in replacement of cement. Further, increase in replacement of Dolomite powder strength gradually

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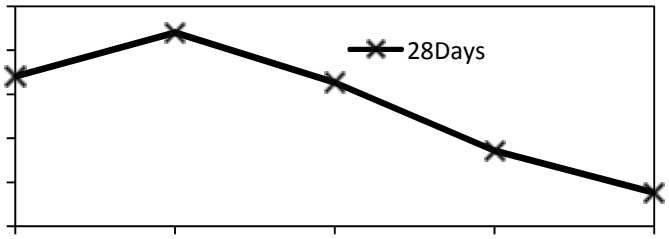
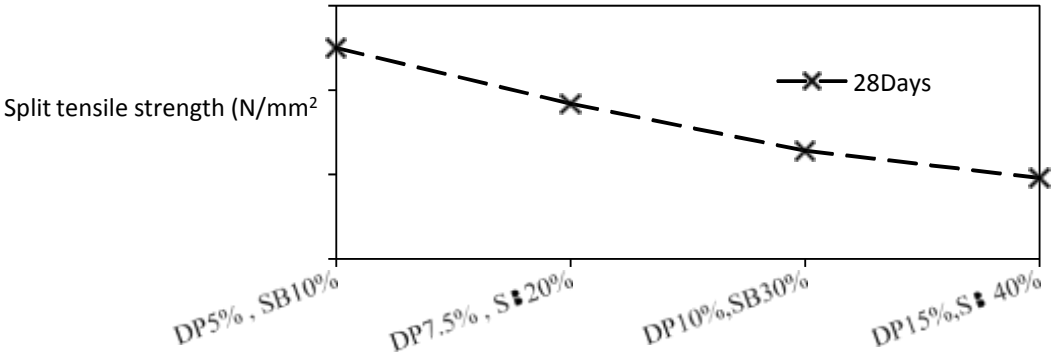
decreases due to the chemical composition of dolomite powder.



Sugarcane bagasse ash percentages

Figure 11 : Split Tensile Strength Test Graph (SCBA)

From the above fig, it is observed that the split tensile strength of concrete varies with different percentages of concrete. The split tensile strength was decreased as the replacement of SCBA increased. SCBA has pozzalonic properties. This pozzalans posses no cementatious value due to this the concrete doesn't able to attain proper strength.



Dolomite powder & sugarcane bagasse ash percentages

Figure 12 : Split tensile strength test graph (combination of dolomite powder & SCBA)

The Split Tensile strength of combination mix i.e., (dolomite powder in cement & SCBA in fine aggregate) concrete has acquire good result at 5% of Dp &10% of SCBA. By increasing the percentage of mixes, gradually the strength of concrete has decreased due to various chemical compositions.

Figure 15 : Flexural Strength Test (Combination Of Dolomite Powder & SCBA)

Figure 16

Figure 17

From the above Fig, The flexural strength of concrete has been reduced gradually due to various chemical compositions, because of the combination of dolomite powder & SCBA the strength has been lowered & did't reach the target mean strength. The reason for this is, in SCBA there are pozzolanic properties which has no cementatious value, by this reason the concrete does't get hardened and the reason for 5% of Dolomite powder in replacement of cement and 10% of SCBA in replacement of FA has gained the strength. SCBA has more percentages of silica compare to that of natural fine aggregate it has 59% silica. Here silica content in FA is more , till some amount of percentage the concrete has gained the strength because of having no cementatious value the water absorption is more, the strength of concrete has been decreased gradually.

Relation Between Compression Strength with Tensile and Flexural Strength :-

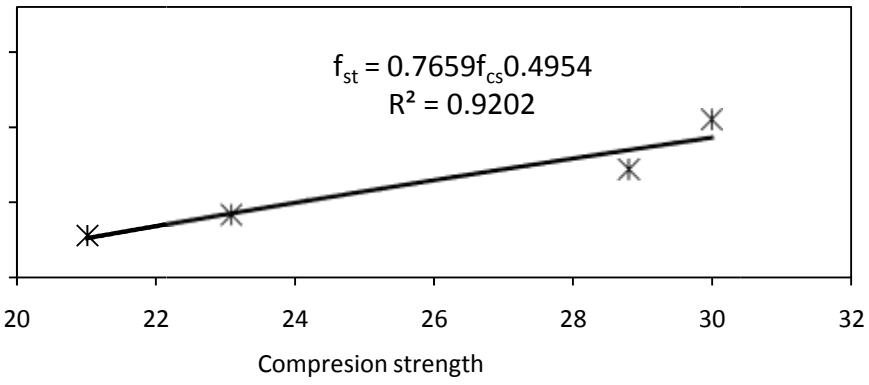
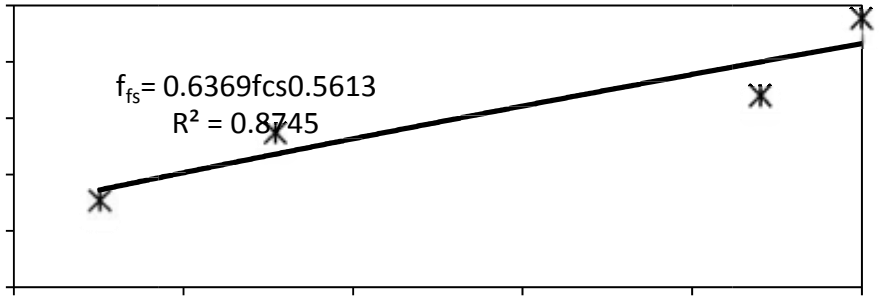


Figure 18 : Relation between compressive strength and split tensile strength



Compressive Strength values (N/mm2)

Figure 19 : Relation between compressive strength and flexural strength

By using regression analysis, the relation between compression test with tensile and flexural test has been implemented (in figure 17 & 18 respectively,). The Regression equations are

1) fst= 0.659fcs0.4954

2) ffs= 0.6369fcs0.5613

6. Conclusion:

Overall, the partial replacement of dolomite powder and sugarcane bagasse ash did't generate any difficulties during casting, curing, testing. However, while increasing the percentages of DP and SCBA, workability of the mix is being reduced.

1) The result of the present investigation is the compressive strength of cubes are raised by replacing of cement with Dolomite Powder upto 7.5% & further any addition of dolomite powder, the compressive strength, split tensile & Flexural strength decreases with the increasing of Dolomite powder percentage.

2) By using SCBA up to 10% as a partial replacement with Fine Aggregate the concrete gave better results w.r.t to compressive & tensile strength.

3) By both the combinations of Dolomite Powder and SCBA, we are getting good results upto 5%, 10% replacements.

4) Dolomite Powder and SCBA becomes economical. It becomes technically and economically feasible and viable.

5) Utilization of SCBA and Dolomite powder will solve the problems of its disposal, Thus keeping the environment free from pollution.

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