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Mechanical Characteristics of Sugarcane Bagasse Ash Along With Nano Particles in Concrete

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Abstract: ***Concrete is considered to be a one of the largest producer of green house gas (CO_2) causes a threat to environment. Sugarcane bagasse ash, pozzolonic in nature can be used as a partial replacement of cement along with nanoparticles. Since surface area of nano particles are relatively higher than other products in concrete they tend to occupy the space between the particles and help improve properties of concrete. Disposing by-products of industrial processes is major environmental problem which can also be solved by replacing cementations materials in concrete. In this project nano TiO2 is which makes concrete stronger, durable and perform better. It improves material resistances and increases their durability. The attempt has been made to use nano TiO2 and Sugarcane Bagasse Ash (SCBA) as cement replacement. Here five proportions have been prepared with SCBA being constant (20%) and nano TiO2 varying (0%, 1%, 2%, 3% and 4%). These samples are casted and cured for 7 and 28 days. The tests conducted in this works were Raw material test, Compressive test, Rapid Chloride Penetration test, Water absorption test. These test results reveal that nano TiO2+SCBA sample shows better performance in all the aspects.***

KEY WORDS: Green house gas (CO_2), Sugarcane Bagasse ash, nano TiO2, Cement replacement.

I. INTRODUCTION

TiO2is typically thought of as being chemically inert. The use of Nano titanium dioxide particles has higher strength, reduces pore size distribution, air voids gets reduced due to Nano particles distribution and faster chemical reaction. TiO2 Nano powder added to concrete as a chemical admixture can give ability to breakdown dirt and pollution enter in and stick to the outer surface(EhsanMohseni et al., 2015), Then it is washed off by rain water on the surface of concrete. Titanium dioxide is a white pigment and can be used as an excellent reflective coating for heat(ErniSetyowati et al.,2014), It is incorporated to block UV light so TiO2 compositions based paints are manufactured in foreign countries and recently imported in India also (Faiz et al., 2014), Since TiO2 separates natural toxins, unstable natural mixes and bacterial film through amazing photograph synergist responses (AnjaEstensenKlause et al., 2017), It gives self-cleaning properties to surfaces to which it is connected (Zerbino et al.,2011), Nano particles respond with Calcium hydroxide created from the hydration of calcium silicates (Jnyanendra Kumar Prusty et al., 2016),

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The rate of pozzolanic response is relative to measure of surface territory accessible for response (Gerrit Land et al.,2015) Therefore it is conceivable to include Nano TiO2 a high immaculateness (99.9%) and a high Blaine fineness esteem (60 m2/g)
so as to improve the attributes of Cement mortars(DivyaChopra et al., 2015), In this work impact of Nano TiO2 on quality, strength, exhibitions and Workability of mixed bond concrete has been examined. 3% of Nano TiO2 particles are included (Gerrit Land et al.,2015), as a substance admixture to cementitious material which is financially obtained in Nano powder structure (HongjianDua et al., 2014), Utilization of Nano-SiO2 and Rice Husk fiery debris improves mechanical(MostafaJalal et al., 2015), and solidness (RahmatMadandoust et al.,2015), properties of cement. By utilizing Eco sand as a fine total up to substitution dimension of 15% toughness (ShaikHussain et al., 2017), and quality of concrete(Mostafa Jalal et al., 2015), was improved. A few Nano Composites was utilized as an expansion in the Portland bond mortar as a substitution of concrete weight (ZemeiWu et al., 2017).

II. MATERIALS AND METHODS

Sugarcane Bagasse Ash (SCBA)

In the wake of consuming sugarcane bagasse as a fuel, the leftover fiery remains is gathered as a side-effect from the cogeneration kettle by utilizing a sack house filte plant (Bahurudeen et al., 2015), The gathered bagasse cinder comprises of fine consumed particles just as coarse un consumed or incompletely consumed particles and is legitimately put away in huge storehouses in the cogeneration, Periodically, this bagasse powder is blended with water and arranged to the closest land(ChitaranjanDalai et al.,2015), The arranged slag was utilized in the investigation. For this examination, crude bagasse fiery debris was gathered from transfer zone and further dried at 105– 110 C for 24 h to expel water(Kawade et al., 2013), The dried example was utilized in this examination to explore its pozzolanic action and definite material characterization(Prashant et al.,2013), The material was acquired from Gobichettipalayam, 26 kg of material got. X-beam diffraction of bagasse fiery debris affirmed the nearness of quartz and cristobalite alongside the shapeless silicahump. Precise system for the creation of SCBA (Fig.1) mixed bonds is abridged in Table 1.

Table 1. Composition of Sugarcane Bagasse Ash

Chemical Compound	Abbreviation	%
Silica	SiO	77.86
Aluminium Oxide	Al_2O_3	2.85

Ferric Oxide	Fe_2O_3	4.76
Calcium Oxide	CaO	4.68
Phosphorus Oxide	P_2O_5	0.23
Magnesium Oxide	MgO	3.61
Sodium Oxide	Na_2O	0.53
Potassium Oxide	K_2O	3.19
Loss on Ignition	LOI	1.86

The impact of various handling strategies (consuming, pounding, compound actuation, sieving and blend of above techniques) on the pozzolanic execution of dried crude bagasse slag was examined. Complete evacuation of carbon rich stringy unburnt particles by sieving through 300μm strainer. The details of SCBA are appeared in Table 2.

Table 2. Specifications of SCBA

Property	Natural Sand	SCBA	Test Method
Specific Gravity	2.64	1.63	IS 2386(Part III)-1963
Fineness Modulus	2.79	1.42	IS 2386 (Part I)-1963

Fig.1. Sugarcane Bagasse Ash

Aggregates

•Construction total or just "total" is a granular material, for example, sand, rock, smashed stone, iron impact heater slag, utilized with a water powered establishing medium to deliver either concrete or mortar. Totals are the most mined materials on the planet.

Fine Aggregates

Fine total are essentially sands won from the land and the marine or stream condition. The stream sand particles for the most part going through 4.75 mm sieve are called fine total are utilized in this by checking the Fineness modulus test.

Coarse Aggregates

Those particles that are predominantly retained on the 4.75 mm sieve are called coarse aggregate. Locally available coarse aggregates having the maximum size of 12.5 mm to 20mm were used in the present work(Ali Nazari et al.,2011).

III. EXPERIMENTATION

Compressive Strength

The compressive quality is estimated by breaking cubical solid examples in a compressive testing machine. The load at which the control example eventually fails is noted (Rahmat Madandoust et al.,2015). The compressive quality is determined from the failure load separated by the cross sectional territory opposing the load.[12,13]

Rapid chloride penetration test

In Reinforced solid structures chloride particle entrance is viewed as a noteworthy reason for erosion of strengthening bars(Rui Zhang et al.,2015,),, Conventional cements neglect to forestall the interruption of dampness and forceful particles sufficiently (Rui Zhang et al.,2015) The utilization advantageous establishing composite materials have been accounted for to build the obstruction of cement to decay by forceful synthetic concoctions, for example, chlorides (TinaSimc et al.,2015), Permeation property of cement is a standout amongst the most basic parameters in the assurance of sturdiness of cement in forceful conditions. The RCPT tests and test was appeared in Fig 2 and 3.

Fig .2. RCPT samples

Fig. 3. Rapid chloride permeability test

IV. RESULTS AND DISCUSSION

Compressive Strength

To determine the compressive strength, three cubes (150mm x 150mm x 150mm) were casted for each mix and for each duration of curing. These samples were tested after 7 and 28 days of curing and the values are given in Table 3.The bar graph was shown in Fig.3.

Table 3. Compressive strength Test (7th and 28th day test)

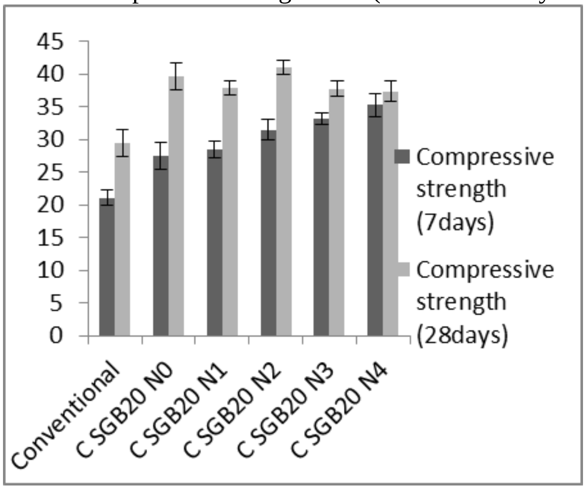

Fig.4. Bar graph diagram of Compressive Strength

Water Absorption test:

The results of water absorption test was given in Table 4 . The line graph of water absorption test was shown in Fig 5.

Table 4. Water Absorption Test (28th Day Test)

S.No	Specimen	Dry weight	Wet weight	Water Absorption
1	Conventional	8.376	8.422	0.38
2	C SGB20 N0	8.236	8.261	0.19
3	C SGB20 N1	8.222	8.258	0.39
4	C SGB20 N2	8.362	8.385	0.22
5	C SGB20 N3	8.435	8.459	0.09
6	C SGB20 N4	8.375	8.406	0.37

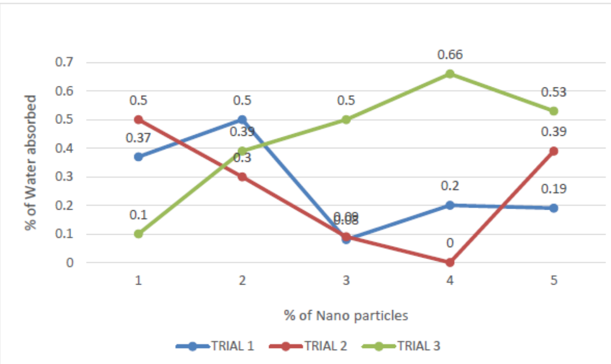

Fig.5. Line graph diagram of Water Absorption Test

V. CHEMICAL TEST

Rapid chloride penetration test

S.No	Specimen	Compressive strength (7days)	Compressive strength (28days)
1	Conventional	21.12	29.53
2	C SGB20 N0	27.53	39.7
3	C SGB20 N1	28.49	37.9
4	C SGB20 N2	31.51	41.1
5	C SGB20 N3	33.11	37.8
6	C SGB20 N4	35.29	37.4

Chloride ion penetrability of both the samples SCBA and SCBA+TiO2 for 28 days were recorded and tabulated in Table 5.The line graph was shown in Fig 6.

Table 5. Rapid Chloride Penetration test (28th day)

S.No	Specimen	Penetration level (mA hours)	Chloride ion passing
1	Conventional	1789.2	Moderate
2	C SGB20 N0	1308.24	Low
3	C SGB20 N1	1330.47	Low
4	C SGB20 N2	1365.03	Low
5	C SGB20 N3	1696.59	Low
6	C SGB20 N4	1830.96	Moderate

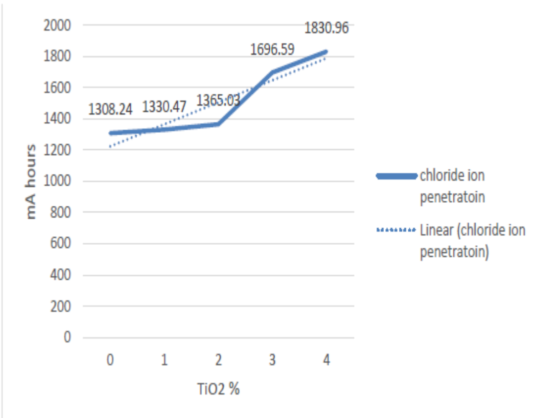

Fig.6. Line graph diagram of RCPT

VI. CONCLUSIONS

The main motto of this study is to analyze the performance of addition of commercially available Nano TiO2 and SCBA as chemical and mineral admixtures in cementitious materials.

To avoid absorption of pollutants and reflect the heat entering in.

The following conclusions were obtained as a result and performance for the tests conducted.

- The readings got from the Cube Compressive Strength test were looked at for 7 and 28 days term of relieving. It is seen that Nano TiO_2 and SCBA tests have more prominent quality than SCBA tests yet less quality when contrasted with ordinary solid samples.
- Rapid Chloride Permeability Test was directed for both the solid examples of Nano TiO_2 and SCBA and SCBA in the wake of restoring time of 28 days. It was discovered that solid containing Sugarcane Bagasse Ash and Nano Titanium dioxide has low chloride infiltration level. Consequently this solid shows low consumption rate as chloride assault is less.

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