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## Enhance the Tensile and Flexural Strength of Concrete by Using Wood Ash, Sugar Cane Bagase Ash and Rice Husk Ash with Partial Replacement of Cement

Prabhjot Singh Devgun<sup>1</sup>, Dr. P.K. Singhai<sup>2</sup>

<sup>1</sup>M. Tech. Scholar, <sup>2</sup>Professor, Department of Civil Engineering

<sup>1,2</sup>Lakshmi Narain College of Technology, Bhopal, (M.P.), India.

### Abstract

A portion of the waste items which have pozzolanic properties and which have been considered for use in mixed bonds incorporate wood fiery debris, fly powder, Silica smolder, Volcanic cinder, copper slag, quarry dust, Rice husk cinder. It is a waste material coming about because of the mechanical processing or preparing of timber into different shapes and sizes. The issues of profitability, economy, quality and condition, they need to rival other development materials. In this investigation three sorts of squanders materials (wood ash, sugar cane bagase ash and rice husk ash) and ordinary aggregate were utilized for preparing cube specimens. There are M25 grade of blended extent are use. Squander materials are use in concrete with the substitution bond of 4%, 8%, 12% and 16%. These beams, cylinder and cube are tries on 7, 14, and 28 days. The, flexural quality, and tensile strength are determined with the help of UTM and CTM machine.

**Keywords:** Split Tensile Strength, Flexural Strength, Workability, wood ash, sugar cane bagase ash and rice husk ash.

### INTRODUCTION

Concrete is a most prevalent development material on the planet. It is made by blending fine and coarse aggregates, water, cement, and added substances in a specific endorsed extent. Concrete has discovered use in generous a large vary of development shape parkway, channel, linings, scaffold, and dams to the most lovely and aesthetic of structures. With the growth of reinforcement to supply required elasticity, propels in basic outline, and the use of pre-pushing and post tensioning, it has turned into the premier auxiliary material. The most ultimate properties of concrete and workability of concrete rely upon aggregate. J.W. Kelly (2001) stated, "One would not consider utilizing wood for a dam, steel for asphalt, or black-top for a building outline, however concrete is utilized for each of these and for some different uses than other development materials. Indeed, even where another material is the main segment of a structure, concrete is normally utilized with it for specific parts of the work. It is utilized to help, to encase, to surface, and to fill. More individuals need to find out about concrete than about other specific materials".

Cement is a coupling material utilized as a part of development exercises. The utilize of concrete is expanded as rate of development expanded. Concrete is used as a part of development of different building and non-designing structures (here and now structures). As determined by the review, 10-12 million tons squander materials are create and consume. We are supplanting the fine aggregates



(Cement) with wood ash, sugarcane bagasse ash and rice husk ash. Decide the properties while supplanting the cement (some rate) with wood ash, sugarcane bagasse ash and rice husk ash. The issues of profitability, economy, quality and condition, they need to rival other growth materials, for example, cement, aggregates, sand and so outward. However this issue can be comprehend by substitute of aggregates and cement with some bonding material or by halfway restoration or by replacement of aggregate with squander materials.

## 2. LITERATURE REVIEW

Relevant studies are carried out on the capability of substitution the wood ash, sugarcane bagasse ash and rice husk ash and reusing it. The discovery of the earlier workers with their conclusions are been summarized within the tabular form for quick understanding of the reviewer.

Rohini, V.Arularasi, (2018). Have perform about impact of quarry dust & fly ash as a fractional replacement of cement and fine aggregate in concrete. Examinations were under taken to deliver minimal effort concrete by mixing in various proportions of hypo slop with cement. The concrete organization can likewise be appropriate for incomplete replacement (up to 60%). The fly ash, quarry shake dust can be used as frame a of 20% substitute of cement & fine aggregate in concrete. It was concentrated to keep away from natural debasement because of industrial squanders shape cement processing plants. The outcomes were empowering in that they uncovered that concrete of the required compressive quality can be created. It is presumed that another development material with minimal effort can be made accessible. Hence we get the Study unmistakably shows that 40% of substitution of cement and fine aggregate by fly ash & quarry shake dust is empowering and the compressive properties is more than the standard concrete. Therefore, 40% replacement is prescribed which may turn out to be practical. The over 40% replacement acquires reserve funds of 30% of the aggregate cost in M30 of concrete.

Perarasan. M, (2017). Has examination that regarding trial think over on halfway substitution of fine aggregate with saw dust & quarry dust. In preparation of fine aggregate with concrete is partly supplanted by saw dust & quarry dust. This examination had been embraced to think about the effect of quarry dust and saw dust by quarry dust of 0%, 10%, 20%, 30% and 40%. Also, saw dust of 0%, 5%, 10%, 15% and 20% with the fine aggregate developed fine aggregate has formed. The compressive and split tensile strength of 30% of quarry dust and 15% of saw dust provides a most extreme of compressive strength of  $36.26 \text{ N/mm}^2$  and split tensile strength of  $3.8 \text{ N/mm}^2$  for 28 days respectively. The experience found within the examination is that the saw dust is often added greatest up to 15% without influencing any of the physical or mechanical properties. An intriguing and most noteworthy point found is by accelerating the amount of saw dust, the value of the complete concrete mix will be diminished and also the weight is reduced up to 20.

N.Kavibala, (2016). Has learned about test examine on fractional substitution of fine aggregate with quarry dust & cement with marble powder with growth of polypropylene fiber. The arrangement of tests are light-emitting diode to think overthe effect of 5%, 10% & 15% substitution of cement with marble powder on compressive strength and split elasticity and contrast it and also the regular concrete and moreover to search out the best substitution of marble powder between 10 percent to 145%. With the best substitution of quarry dust & marble powder is swapped for fine aggregate at 10%, 20% & 30% and tested for compressive strength and split rigidity. With these ideal outcomes polypropylene fiber is included for promote change in quality. The Compressive strength of Cubes is expanded with the expansion of marble powder up to 12% substitute by weight of cement. Optimum rate of substitution of cement with marble



powder and fine mixture with quarry dust is 12% and 30 min. The compressive strength is expanded around 8.5% and part elasticity is expanded around 8.57% once contrasted with regular concrete. There is diminishing in workability as the replacement level increments, and henceforth the super plastizer is utilized. The compressive strength of concrete expanded around 13.87% and split elasticity is expanded around 15.08% with the further expansion of 0.5% polypropylene fiber by load of cement to the concrete.

### 3. MATERIALS

#### **Cement**

OPC is most ordinary type of cement is generally use all over the world. It retard the faster setting time of cement. In this experimental work the OPC is used with 43 grade validate to Indian Standard IS 8112-1989 is used. OPC is environmental friendly & economical. OPC at different grade (OPC 53, OPC 43, and OPC 33) it's utilizing in general purpose in India.

#### **Aggregates**

Aggregate can be classified as normal weight, light weight, heavy weight aggregate. Aggregate usually exist of natural sand and gravel, crushed rock or mixture of those materials. Natural sand and gravels are most generally used and can be acquired economically in sufficient quality. Crushed rock is widely used for coarse aggregate The state of the particles of crushing rock depends to a great extent on the kind of rock and technique for crushing. Artificial aggregates is generally used in certain localities consist mainly of crushed, air-cooled blast-furnace slag and especially burned clays.

#### **Sand**

Aggregate which go from 4.75 mm sifter and contains just so considerably coarser material as allowed, fine aggregate is regular sand which is coming about because of the characteristic crumbling of shake and which has been stored by streams or frosty offices, it is likewise pounded stone sand which is created by pulverizing hard stone, it is additionally smashed rock sand which delivered by squashing common rock. Sand, rock, residue and mud are for the most part results of all characteristic and simulated deterioration of shake sand minerals.

#### **Mixing water**

As a rule, if water is potable, it'll be used as mixing water. Water should not have excess undesirable organic or inorganic substances which can potentially have an adverse effect not only in the strength, but also in the setting time, surface efflorescence (deposits of white salts on the surface of concrete), and resistance to degradation. The blending water needs to be clear and apparently clean free of substances that discolor it, makes it taste or smell in uncommon manner.

#### **Wood Ash**

Wood ash is a waste material the residue powder left after the combustion of wood, such as burning wood in a home fireplace or an industrial powerhouse. It used commonly by gardeners as a great origin of potash. Once it's not soft is termed setting. Wood powder is essentially carry out of potassium, phosphorus, calcium, and magnesium, additionally contains follow measures of iron, manganese, sodium, boron, zinc, copper, and molybdenum.

#### **Sugarcane Bagasse Ash (SCBA)**



This bagasse ash is generally spread over farms and dump in ash pond which causes environmental problems also research states that Workplace exposure to dusts from the processing of bagasse can cause the chronic lung condition pulmonary fibrosis, more specifically referred to as bagassosis. So there is great need for its reuse, also it is found that bagasse ash is high in silica and is found to have pozzolanic property so it can be used as substitute to construction material.

### **Rice Husk Ash (RHA)**

India is one of the world's largest producers of white rice, accounting for 20% of all world rice production. Rice is India's preeminent crop, and is the staple food of the people of the easterly and southern regions of the state. The country's rice output of 89.13 million tonnes in 2014-15 crop year. India could achieve a record rice production of 100 million tonnes in 2015-16 crop years on the back of better monsoon this year. The India's rice production reached a record high of 104.32 million tonnes in 2016-2017 crop years. Disposal of rice husk ash is an important issue in these countries which cultivate large amounts of rice. Rice husk has a very low nutritional value and as they take very long to decompose are not appropriate for composting or manure. Hence the 100 million tons of rice husk produced globally begins to affect the environment if not disposed of properly.

### **Split Tensile Test**

The splitting tests are notable backhanded tests utilized for deciding the rigidity of cement once in a while alluded to as split elasticity of cement. The elasticity of cement can be acquired indirectly by subjecting a solid barrel to the activity of compressive drive along to inverse closures of a generator as shown in the Figure.1



**Figure 1: Split Tensile Strength Test.**

### **Flexure Strength Test**

Flexural strength, additionally called modulus of rupture, bending strength or fracture strength a mechanical parameter for hard material, is clear as a material's perform to prevent deformation below load. It's defined the normal tensile stress in concrete, when cracking happens in a flexure test. This tensile stress is the flexural property of concrete and is calculated by the utilization of formulas which is considered that the section is uniform.



**Figure 2:** Flexure Strength Test.

#### 4. RESULTS AND DISCUSSION

##### Split Tensile Strength Test

The result of the Split tensile strength determine by compression testing machine, with the incomplete substitution of wood ash, sugar cane bagase ash and rice husk ash by cement with level of 5%, 10%, 15% and 20% with result determine the age of 28 days are appeared in the fig. 3 for M-25 concrete.

##### Split Tensile Strength of Cylinder Concrete Contain Wood Ash

The split tensile strength of concrete material is tried by making cylinder of size 150mm x 300mm and is consistently cured for 28 days testing. Absolutely 39 cylinder were casted for ordinary M25, grade and for 5%, 10%, 15% and 20% by weight fractional substitution of wood ash for cement. Three examples are tried and the normal esteems are taken as tensile strength of concrete. The estimations of split tensile strengths are appeared in table 1.

**Table 1:** Split Tensile Strength of M25 having Wood Ash.

Tensile Strength in $N/mm^2$ Contain Wood Ash					
Day's/ %	0%	5%	10%	15%	20%
28	2.17	1.95	1.51	0.81	1.73

From the above table is seen that the tensile strength in M 25 grade of concrete at 28 days are decrease when the percentage of the wood ash increment from 0% to 20%.

##### Split Tensile Strength of Cylinder Concrete Contain SCBA

The split tensile strength of concrete material is attempted by making barrel of size 150mm x 300mm and is reliably cured for 28 days testing. Totally 39 cylinders were threw for standard M25, grade and for 5%, 10%, 15% and 20% by weight fragmentary replacement of SCBA for cement. Three illustrations are attempted and the ordinary regards are taken as tensile strength of concrete. The estimations of split tensile strengths are given in table 2.

**Table 2:** Split Tensile Strength of M25 having SCBA.

Tensile Strength in $N/mm^2$ contain SCBA					
Day's / %	0%	5%	10%	15%	20%
28	2.17	2.40	2.75	2.23	2.51

From the above table is seen that the tensile strength in M25 review of concrete at 28 days are increments when the level of the SCBA increment from 0% to 20% usage of SCBA.

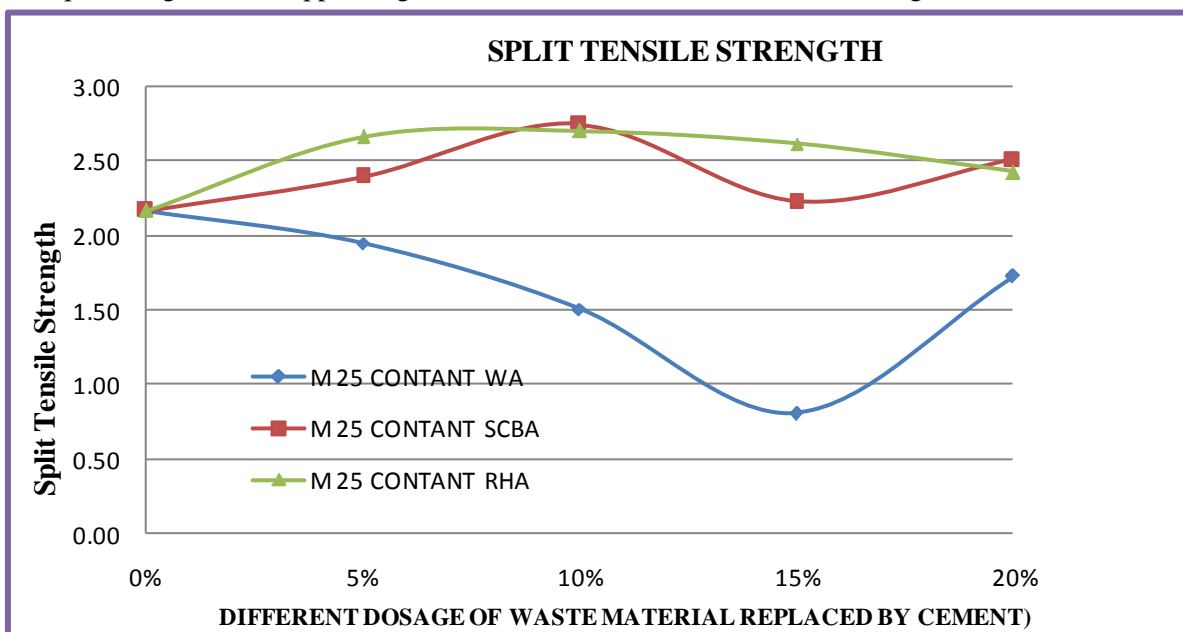
### Split Tensile Strength of Cylinder Concrete Contain RHA

The split tensile strength of concrete material is attempted by making chamber of size 150mm x 300mm and is reliably cured for 28 days testing. Completely 39 cylinders were casted for standard M25, grade and for 5%, 10%, 15% and 20% by weight fragmentary substitution of RHA for cement. Three illustrations are attempted and the typical regards are taken as tensile strength of concrete. The estimations of split tensile strengths are given in table 3.

**Table 3.** Split Tensile Strength of M25 having RHA.

Tensile Strength in $N/mm^2$ Contain RHA					
Day's/ %	0%	5%	10%	15%	20%
28	2.17	2.67	2.71	2.62	2.43

From the above table is seen that the tensile strength in M25 review of concrete at 28 days are higher than when the percentage of the copper slag are increases from 5, 10, 15 and 20% usage of RHA.

**Figure 3:** Split Tensile Strength of WA, SCBA and RHA.



### Flexural Strength Test

Flexural power additionally called as modulus of rupture. In concrete flexure is the bowing minute caused by the applied load, in which a concrete beam has pressure at top and tensile worry at the base side. Shafts on testing will bomb in strain because of its property and shear will show up on concrete.

In this test works absolutely 39-beams of size 700 x 150 x 150 are casted of M25 grades concrete and other level of replacements concerning 5%, 10%, 15% and 20% by wood ash, sugar cane bagasse ash and rice husk ash with cement. At that point analyze the estimations of both plan blends. The flexural estimations of various blends.

### Flexural Strength of Beam Contain Wood Ash

The results are determined from UTM with M25 grade of contain wood ash with the substitution of cement as shown in Table 4.

**Table 4:** Flexural Strength of M25 having Wood Ash.

Flexure Strength in Div. Contain Wood Ash					
Day's/ %	0%	5%	10%	15%	20%
28	15.60	17.30	11.60	11.30	9.30

From the above table it observed that the flexure strength in M25 grade of concrete at 28 days. Flexure Strength is increase when the 5% of wood ash increment and abatement from 10%, 15% and 20% used of wood ash.

### Flexural Strength of Beam Contain Sugar Cane Bagasse Ash

The results are determined from UTM with M25 grade of concrete contain SCBA with the substitution of cement as shown in Table 5.

**Table 5:** Flexural Strength of M25 having SCBA.

Flexure Strength in Div. Contain SCBA					
Day's/ %	0%	5%	10%	15%	20%
28	15.60	22.30	19.30	11.00	24.46

From the above table is seen that the flexure strength in M25 grade of concrete at 28 days. Flexure strength is increase when the 5% 10% & 20% of SCBA increment and reduction from 15% used of SCBA.

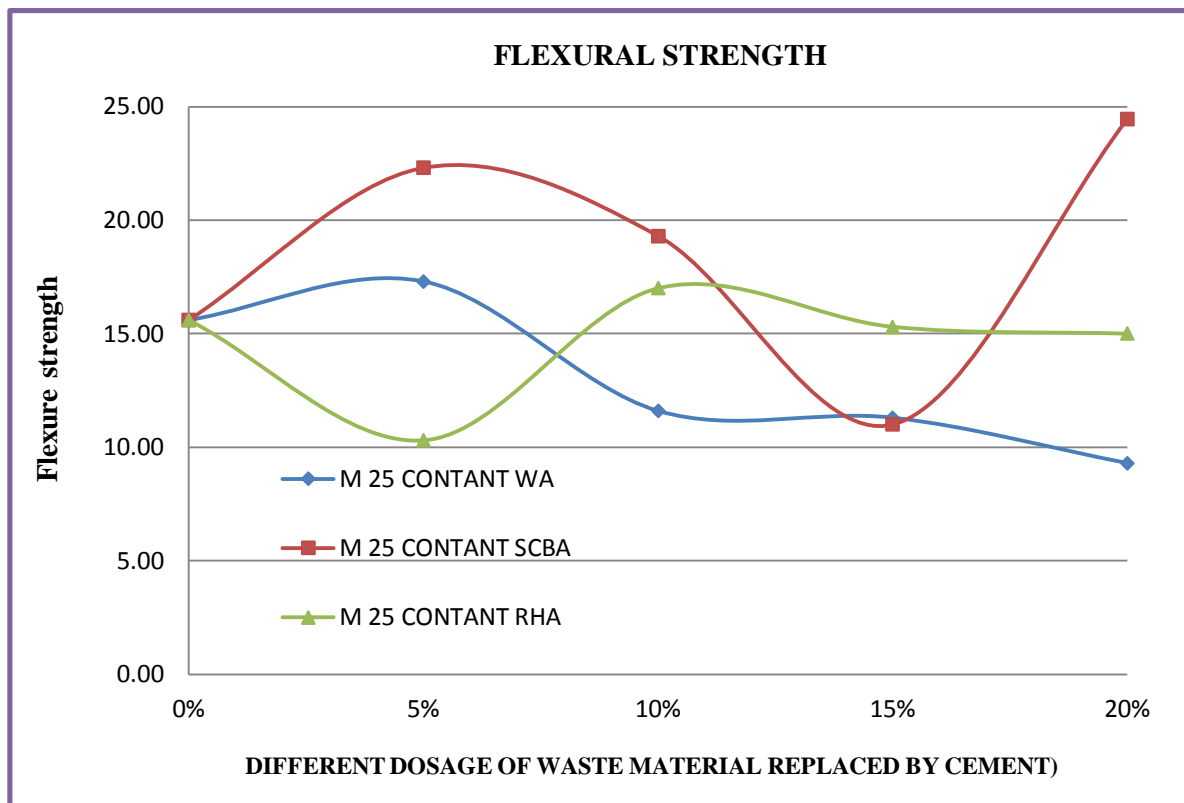
### Flexural Strength of Beam Contain Rice Husk Ash

The results are determined from UTM with M25 grade of concrete contain RHA with the substitution of cement as shown in Table 6

**Table 6** Flexural Strength of M25 Having RHA

Flexure Strength in Div. Contain RHA					
Day's/ %	0%	5%	10%	15%	20%
28	15.60	10.30	17.00	15.30	15.00

From the above table is seen that the flexure strength in M25 grade of concrete at 28 days. Flexure strength is increase when the 10% and 15% of RHA increment and reduction from 5% and 20% used of RHA.



**Figure 4:** Flexural Strength of M25 Grade Contains of WA, SCBA and RHA.

Flexural strength is increments when the 5% 10% and 20% of level of the SCBA increment and reduction from 15% used of SCBA with the age of 28 days.

Flexural strength is increases when the 10% and 15% of level of the RHA increment and decline from 5% and 20% used of RHA with the age of 28 days.

### 5. CONCLUSION

- Slump shows that the workability increase with the increase in the percentages of contain wood ash, sugar cane bagase ash and rice husk ash. All investigated containing wood ash, sugar cane bagase ash and rice husk ash mixtures had height slump values and acceptable workability.
- Flexural strength is increments when the 5% of level of the wood ash increment and decreasing from 10%, 15% & 20% with the age of 28<sup>th</sup> days. Flexural strength is increments when the 5% 10% and 20% of level of the RHA increment and reduction from 15% with the age of 28<sup>th</sup> days.
- Flexural strength is increments when the 10% and 15% of level of the SCBA increment and decline from 5<sup>th</sup> and 20% with the age of 28<sup>th</sup> days.
- Tensile strength of concrete is decreases with the replacement of wood ash. But, tensile strength is expanded with the replacement of SCBA and RHA increments with the age of 28<sup>th</sup> days.






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