EFFECT ON STRENGTH PROPERTIES OF CONCRETE BY USING QUARRY DUST, COPPER SLAG AND WOOD ASH AS PARTIAL REPLACEMENT OF CEMENT

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Abstract: The scope of this analysis is to achieve the industry taking into consideration the feasible use of quarry dust, and to search out any gaps in present situation. The term feasible use means the use of quarry dust to their maximum capacity to adapt up to the demands of this, unexpectedly preserving natural assets and finding answers for limit the environmental effects connected each with quarry dust creation and its disposal. The usage of quarry dust in bond and cement gives potential natural further financial points of interest for every related industry, especially in zones wherever a considerable amount of quarry dust is composed. In this analysis, the experiment work is performed by using cement, fine aggregate, coarse aggregate, quarry dust. The examples were casted for M25 grade of concrete by supplanting the cement 0%, 5%, 10%, 15% and 20% by quarry dust and tested for workability by slump test, compressive strength, flexure strength and split tensile test at the age of 7, 14, and 28 days. It is seen that the strength results represents that concrete casted with in M 25 grade of concrete at 7 days are decreases with replacement of 5%, 15% and 20% at 10% have increments, and 14, 28 days have decreased with replacement of 5%, 15% to 20% and increase at 10%, when the percentage of the quarry dust increase from 0% to 15% .
Keywords: Compressive Strength, Flexure Strength, Quarry Dust, Split Tensile Strength, Workability.

I. INTRODUCTION

The main Ingredients of conventional concrete are cement, sand and aggregate. Performance of concrete is affected by properties of aggregate, therefore fine aggregate is an important part of concrete. The mostly used fine aggregate is the sand extracted from river banks. Natural sand value is expensive because of the excessive cost of transportation from natural sources. Also large-scale extraction of river banks depletes natural resources. To endeavor this aim , one way is to go for long lasting solutions i.e., To opt for sustainable building materials for construction from the byproducts that are generated by manufacturing industries, mines , as waste is certainly a good potential resource and a lot of energy can be recovered from it; and the term 'green' in the present scenario implies to take into consideration use of long term materials copper slag (CS) and cement by-pass dust (CBPD) addition on concrete properties Results showed that 5% copper slag substitution for Portland cement gave a similar strength performance as the control mixture, especially at low w/b ratios (0.5 and 0.6). Higher copper slag (13.5%) replacement yieldedlike stone dust or recycled stone, recycled metal and other products that are not harmful , can be reused and recycled. In addition to this suitable substitution for the replacement of natural aggregates in concrete is a matter of concern. As a result reasonable researches with intended solutions have been done to find the feasibility of quarry dust in conventional concrete. Quarry dust is a byproduct that is generated from the crushing plants and which is abundantly available to an extent of millions of tons per year associated with disposal problems and serious environmental effects. [1]Mineral aggregate production produces a major amount of environmental waste within the form of fine material (quarry dust powder) this is especially a concern for the aggregate the mixture process for factory-made fine aggregate to be used in Portland cement concrete because of standards and performance requirements.

These granite fines are often referred to as quarry or rock dust, a by-product in the production of concrete aggregates during the crushing process of rocks. This residue generally represents less than 1% of aggregate production. In normal concrete, the introduction of quarry dust to mixes is limited due to its high fineness. Its addition to fresh concrete would increase the water demand and consequently the cement content for given workability and strength requirements. Thus, the successful utilization ofquarry dust in SCC could turn this waste material into a valuable resource.Another potential benefit in the utilization of quarry dust is the cost saving. Obviously, the material costs vary depending on the source.

In Singapore, the price of limestone powder as delivered can be as high as Portland cement (OPC). In this respect, the utilization of quarry dust could play a part in lowering the supply cost of SCC, which is currently some 80– 150% higher than that of normal concrete. In Sweden, the application of SCC is well established and according to Petersson, the cost of SCC is only 10% – 15% higher, while in France. The cost is 50% – 100% higher than normal concrete. Although SCC offers many technical and overall economical benefits, the higher supplied cost of SCC over normal concrete has limited its applications. Attempt to reduce the cost of construction with SCC based on a sandwich concept need to be made.

II. LITERATURE REVIEW

Kamlesh Saini Kamlesh Saini (2017) Learned about the impact on quality characteristic of concrete by utilizing squander wood powder as incomplete substitution of cement. The primary point of this undertaking is use of squander materials (wooden powder) as fine aggregates which are blended (expansion and fractional substitution) with OPC to investigate the effect of these squander materials on different limit of concrete review i.e. M30. The wooden dust is supplanted in changing extent set up of sand (0%, 5%, 10%, 15%, and 20%). Undertaking is figured that the substitution of fine aggregates by wooden powder in concrete for the most part expands a definitive quality of concrete. The accompanying focuses are as:

- The compressive quality, flexural quality and split elasticity were decreased as the wooden dust is expanded over 25%.
- The substitution of 10% wooden powder with sand, there is around 10% lessening in weight and 3% diminishment underway cost.
- We are investigating to locate the ideal extent of the wooden powder by which the most extreme quality is accomplished and the concrete will have light in weight differ with the typical concrete and condition well disposed.

Rohini, V.Arularasi, (2017). 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.

Lakshmidev (2015) dissected the effect of quarry dust & fly ash on characteristics of concrete. In the existing work an effort is made to ponder the effect of concrete when cement is supplanted by fly ash at 0, 10, 20 & 30% by weight of cement and sand by quarry dust at 20, 30 & 40% for M20 blend. The exploratory examinations are made to get the characteristics of concrete like the pressure quality at the curing age of 7th, 14th, 28th, 56th & 90th days and compressive properties of chambers, split rigidity, modulus of flexibility and ultrasonic heartbeat speed of concrete at 28th days of curing period. Concrete blends were created, tried and contrasted and the traditional concrete.

- Fly ash expends more water for consistency and workability.
- Addition of fly ash to cement upgrades the underlying setting time though diminishes the last setting time.
- In general, all the blends accomplish more than the objective quality when compared with the controlled concrete regardless of curing period.
- The concrete containing 20% fly ash & 30% quarry dust is thought to be the ideal blend from compressive properties, rigidity and modulus of flexibility of concrete perspective and also from quality perspective.

D.W.S. Ho et. al. (2017) has deals with the utilization of alternative materials, such as quarry dust, for SCC applications. Results from rheological measurements on pastes and concrete mixes incorporating limestone or quarry dust were compared. It was found that the quarry dust, as supplied, could be used successfully in the production of SCC. However, due to its shape and particle size distribution, mixes with quarry dust required a higher dosage of super plasticizer to achieve similar flowproperties.

M. Galetakis et. al. (2013) has focused on the development of a simple method for the productionofbuildingelementsin order to massively recycle quarry dust was investigated at laboratory scale: the production of building blocks by means of compaction mouldings. The optimal mix design, as well as the compaction pressure and water content were determined during the experimental procedure. The produced specimens were cured and tested in order to evaluate their major mechanical and physical properties. Results indicated that the production of building elements with market-acceptable quality characteristics isfeasible.

III. METHODOLOGY

A.GENERAL:-In this chapter, discussion and analysis of laboratory test results of copper slag, wood ash & quarry dust for its suitability as cement replacing material are discuss and analyzed. The methodology took after, tests directed for determination of configuration blend is examined in this part .The properties considered in this investigation are zone of sand, assimilation limits of aggregates, surface dampness of aggregates ,mass thickness of aggregates, fineness of concrete .the trial program is comprehensively grouped into following classes, viz.

1) Specific gravity Test :

- Specific gravity Test for cement
- Specific gravity Test for fine aggregates
- Specific gravity Test for coarse aggregates

2) Water absorption Test

Water absorption Test for fine aggregates

- Test for coarse aggregates
- Sieve analysis
- Surface moisture Test
- Bulk density Test

- Water adsorption
- Fineness of cement Test .

Compressive StrengthTest
Many of the important properties of concrete like the modulus of elasticity, resistance to shrinkage, and creep and durability improve with the increase in compressive strength. This is most extreme imperative which gives a thought regarding all the qualities of concrete. By this single test we can judge that whether concreting has been carried out legitimately or not. For block test two sorts of examples either samples of (15 x 15 x15) cm^3alternately 10 cm x 10 cm x 10 cm size of aggregate are utilized. For the greater part of the works cubical moulds of size (15x15x15) $cm^3$are generally used. This concrete is spilled in the mould and tempered appropriately so as not to have any voids. Following 24 hours these moulds are uprooted and test examplesareplacedinwaterforcuring. The surface of these samples ought to be made even and smooth. This is carried out by putting cement paste andspreading easily on entire zone of specimen. These examples are tried by pressure testing machine following 7 days curing or 28 curing. Burden ought to be connected progressively at therate of 140 kg/cm^2 every moment till the specimens falls flat. Load at the disappointment partitioned by region of example gives the compressive quality of concrete. In this work the compressive strength were tested at the age of 7, 14, 28 and 50 days of the curing.

Flexure StrengthTest
It is defined as the normal tensile stress in concrete, when cracking occurs in a flexure test. This tensile stress is the flexural strength of concrete and is calculated by the utilization of formulas that assumes that the section is consistent.

$f = (M/I)y$
Where, f = Stress in the extreme fiber.
M = Bending moment at the failure section.
y = extreme fiber-distance from the neutral axis.

In this work three specimens were casted in the as per the size specified above. And it tested after 7, 14, 28 and 50 days ofcuring.

Split TensileTest
The elasticity of cement can be obtained indirectly, by subjecting a solid barrel to the activity of compressive drive along to inverse closures of a generatorDue to the compressive force the cylinder is subjected to an oversized magnitude of compressive stress close to the loading region. The large portion is subjected to a uniform tensile stress acting horizontally. This tensile s tress is taken as an index of the tensile strength of concrete and is given by the formula.

IV. RESULT & DISCUSSION
In this chapter, discussion and analysis of laboratory test results of copper slag, wood ash & quarry dust for its suitability as cement replacing material are discuss and analyzed. The experiment was executed with the different percentage of the various materials. Wood ash, copper slag, quarry dust is performed with M-25 Grade of concrete blend with the different percentage (0%, 5%, 10%, 15%, 20%). The different characteristics of the squander materialsinvestigated

4.1 CONSISTENCY OF CEMENT TEST

S.No.	Material	Percentage of Replacement				
		0%	5%	10%	15%	20%
1	Wood ash	32	32.5	33	34	34.5
2	Copper slag	32	33	33.5	34.5	35
3	Quarry dust	32	32.5	34	34.5	35.5

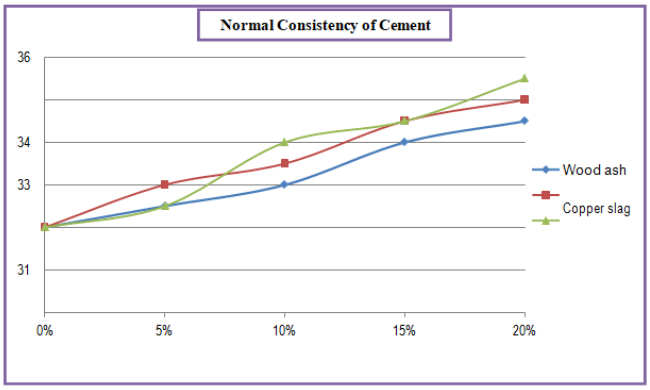


Figure 1:Normal Consistency of Cement

4.2 Workability of concrete

Table3.Workability of Cement with Different Properties of Different Material

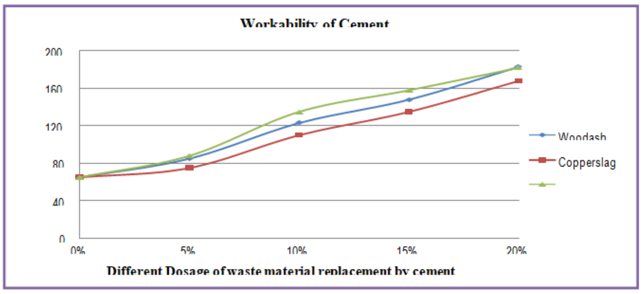


Figure 2: Slump Values of Different Waste Material

Compressive Strength of Containing wood ash with M25 Grade

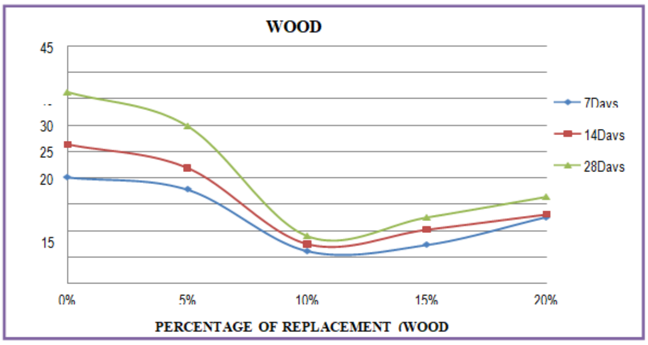


Figure 3:Compressive Strength of Containing wood ash with M25 Grade

Compressive Strength of Containing copper slag with M25 Grade

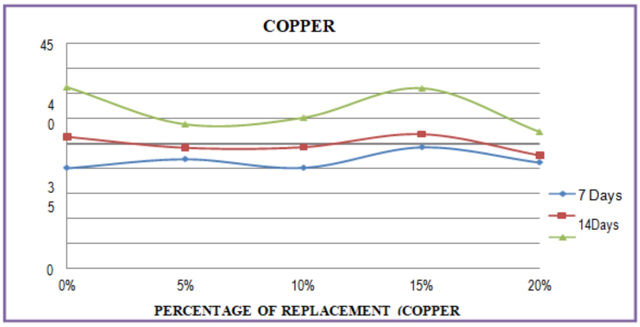


Figure4:Compressive Strength of Containing copper slag with M25 Grade

Compressive Strength of Containing QuarryDust with M25 Grade

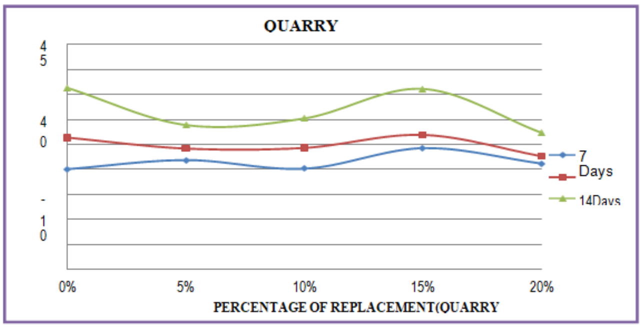


Figure5:Compressive Strength of Containing quarry dust with M25 Grade

SPLIT TENSILE STRENGTH TEST

The result of the Split tensile strength determine by compression testing machine, with the fractional replacement of wood ash, quarry dust, & copper slag by cement with M25, grade and for 5%, 10%, 15% and 20% with result determine the age of 28 days are appeared in the fig. 11 for M-25 concrete.

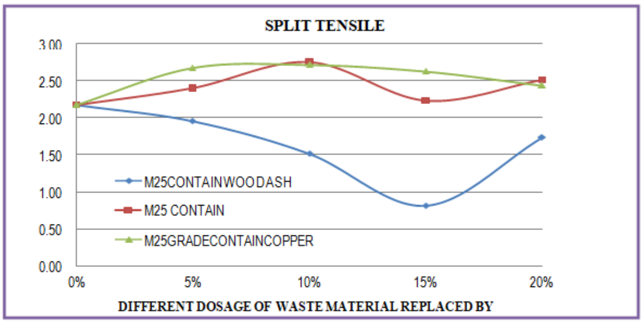
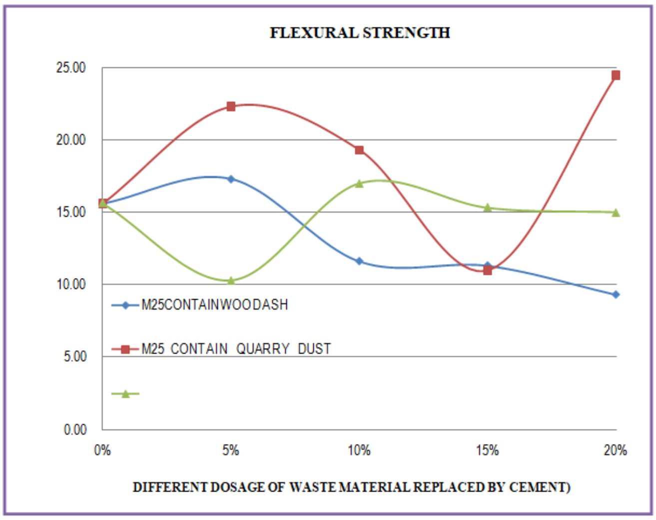


Figure 4.6 Split Tensile Strength of Copper Slag, Wood Ash & Quarry Dust

FLEXURAL STRENGTH TEST

In this test works completely 24 light emissions 700 x 100 x 100 are casted of M30 grades concrete and other degree of substitutions concerning M25, grade and for 5%, 10%, 15% and 20% by wood ash, copper slag, & quarry dust with concrete. By then examine the estimations of both arrangement mixes. The flexural estimations of different mixes.



V. CONCLUSION

From the above experiments, the study concentrate on the relative performance of concrete by utilization the copper slag, wood ash & quarry dust as partial substitute of cement. In the current work the strength analysis is execute which is analyzed in the followingpoints:

- All of the concrete containing copper slag, wood ash & quarry dust showed normal consistency equal and more than the control concrete. Up to 5% 10%, and 15% of replacement the normal consistency was mostly constant minor differences, at 20% replacement the normal consistency had shown a slight increment to35%.
- Slump shows that the workability increase with the increase in the percentages of contain copper slag, wood ash & quarry dust. All investigated containing copper slag, wood ash & quarry dust mixtures had height slump values and acceptable workability.
- The compressive strength outcome represents that as the proportion of wood ash increases for M25 grade, compressive strength is decreased, when the level of the wood ash increment from 0% to20%.
- The compressive strength outcome represents that concrete casted with M25 grade at 7th, 14th,& 28thdays are decrease with replacements of 5% to 10%, and increments, when the level of the copper slag increment from 15% to 20% at 7th, 14th, and 28thdays.
- The compressive strength outcome represents that concrete casted with M25 grade at 7thdays are decreases with replacement of 5%, 15%, 20% & 10% have increments, and 14th, 28th days have decrease withreplacement of 5%, 15% to 20% and increments when the percentage of the quarry dust increase from0% to 15% and slightly decreased with 20% replacement at 28th days.
- Flexural strength is increments when the 5% of level of the wood ash increment and decreasing from 10%, 15% & 20% with the age of 28th days. Flexural strength is increments when the 5% 10%

and 20% of level of the quarry dust increment and reduction from 15% with the age of 28th days. Flexural strength is increments when the 10% and 15% of level of the copper slag increment and decline from 5th and 20% with the age of 28thdays.

- Tensile strength of concrete is decreases with the replacement of wood ash. But, tensile strength is expanded with the replacement of copper slag and quarry dust increments with the age of 28thdays.

5.3 FUTURE SCOPE

- In this investigation we have partially replaced cement with copper slag, wood ash & quarry dust. In future it can utilize as waste material because it's economical, cost effective and environment friendly.
- In this experimental work has been done for M-25 grade of concrete, in future work different grades of concrete can beused.
- In future work we can partially replace cement for high strength of concrete with copper slag, wood ash & quarry dust and reduce cost ofconstruction material.

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