A STUDY ON STRENGTH OF CONCRETE WITH PARTIAL REPLACEMENT OF SAND BY COPPER SLAG, SAW DUST & PLASTIC WASTE

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Abstract: - Concrete is an extensively used construction material for its various advantages such as low cost, availability, fire resistance etc. Due to increased construction activities for different regions and utilities scaring of natural resources is being forced due to its over exploitation. In this paper we presents At first, all cubes beams and cylinders are casted with traditional method for M 30 grade of concrete. Later same are casted by replacing Sand with 0%, 15%, 30%, and 45% CS, SW & PW .The studied were carried out with the compressive, flexure, split tensile and workability test with M30 grades of concrete. The behavior of the specimen has to be studied and compared with each other

Keywords: - concrete, Copper Slag, partial, Saw Dust, Plastic Waste, compressive strength, crushing loads, Flexural strength.

1. INTRODUCTION

Concrete is a freshly mixed material which can be moulded into any shape. The relative quantities of cement, aggregates and water mixed together, control the properties of concrete in the wet state as well as in the hardened state. The main constituents of concrete such as sand, stone and water are mainly natural resources. They are not produced in laboratory or in an industry; they are obtained from the nature and processed to make it perfect for aggregate.

Concrete is a mixture of cement, sand, coarse aggregate and water. Its success lies in its versatility as can be designed to withstand harshest environments while taking on the most inspirational forms.

Engineers and scientists are further trying to increase performance of the concrete with the help of innovative chemical admixtures and various supplementary materials. Concrete is composite material composed of coarse aggregate bonded together with fluid cement which hardens over time. Most concretes used are lime-based concretes such as Portland cement concrete.

An Investigation relating to find out the utilization of byproducts to enhance the functions of concrete has been about for many years. In the latest years, the researchers have been finding out to reuse industry by-products for example fly ash, silica fume, ground granulated blast furnace slag, glass cullet, etc., in concrete manufacturing and civil applications. The capacity makes use of industrial by-products in concrete or as a fractional aggregate substitution or as a partial cement substitution, depending on their chemical management and particle volume. The usage of these resources in concrete comes from the environmental constraints inside the secure disposal of these products. Big interest is being focused on the environment and safeguarding of natural resources and recycling of waste materials. Various industries are producing a important number of products which incorporate residues for example broken aggregates, broken asphalt concrete, foundry sand, copper slag, fly ash, glass cullet, polyethylene terephthalate, HDPE.

OBJECTIVES OF THE THESIS

The overall targets of this examination work is to discover the properties of new and solidified concrete for M30grade of concrete at different concrete substitution rates of 0%, 15%, 30%, and 45% from CS, SW & PW. In this trial study compressive quality, split elasticity, flexural quality and functionality of concrete have been discovered.

Specific objectives

- The particular goals of this examination work can be expressed quickly as follows:
- To decide ideal portion of supplanting material CS, SW & PW by performing distinctive routine research center test on concrete.
- Assessment of the presentation of glue and mortar made of glass powder as a substitution material by directing consistency tests on the new concrete
- Assessment of the functionality of concrete on field.
- Assessment of the compressive quality of solidified concrete for M30 Evaluation of the rigidity of solidified concrete for M30. Evaluation of the flexural quality of solidified concrete for M30

II. LITERATURE REVIEW

Suchithra S (2015) Electronic waste is an emerging issue posing serious pollution problems to the human and the environment. The disposal of which is becoming a challenging problem. For solving the disposal of large amount of E-waste material, reuse of E-waste in concrete industry is considered as the most feasible application. Due to increase in cost of normal coarse aggregate it has forced the civil engineers to find out suitable alternatives to it. E-waste is used as one such alternative for coarse aggregate.

Owing to scarcity of coarse aggregate for the preparation of concrete, partial replacement of E-waste with coarse aggregate was attempted. The work was conducted on M20 grade mix. The replacement of coarse aggregate with E-waste in the range of 0%, 5%, 10%, and 15%, Finally the mechanical properties and durability of the concrete mix specimens obtained from the addition of these materials is compared with control concrete mix. The test results showed that a significant improvement in compressive strength was achieved in the E-waste concrete compared to conventional concrete and can be used effectively in concrete. The reuse of E-waste results in waste reduction and resources conservation.

Saranya K (2016) Owing to scarcity of coarse aggregate for the preparation of concrete, partial addition of E-waste with coarse aggregate was attempted. The work was conducted on M25 grade mix. The addition of coarse aggregate with E-waste in the range of 0%, 32%, 34%, 36%, and 38%. Finally the mechanical properties and durability of the concrete mix specimens obtained from the addition of these materials is compared with control concrete mix. The test results showed that a significant improvement in compressive strength was achieved in the E-waste concrete compared to conventional concrete and can be used effectively in concrete. The reuse of Ewaste results in waste reduction and resources conservation.

Hardik Dhull et al. (2007), Saw dust is also known as wooden dust. It is the remains of cutting & drilling wood. It is composed of fine particles of wood, certain inserts which live in wood such as carpenter out. It is produced as small irregular chips or small garbage of wood during sowing the logs of wood into different sizes. In this study, saw dust ash prepared from uncontrolled burning of saw dust is evaluated for it suit ability as partial cement replacement in concrete. The strength parameters i.e. compressive strength of concrete with blended saw dust ash cement are evaluated & studied by replacing cement by 5%, 10%, 15%, 20% by wt. to OPC Slump Test was carried out on fresh concrete & compressive strength test was carried out on hardened concrete. Several cubes were tested at 7 and 28 day. The result showed that saw dust ash is good replacement material for cement with Si02, Al2O3 & Fe2O3 of 72%. The slump value decreased with increase in saw dust ash. The compressive strength increased up to 10% SDA content and then decreased with further increase of SDA content.

C. Marthong et al. (2012), the possibility of using Sawdust Ash (SDA) as a construction material was experimentally investigated. Saw dust was burnt and the ash sieved using a 90 micron sieve. Three grades of ordinary Portland cement (OPC) namely; 33, 43 and 53 as classified by Bureau of Indian Standard (BIS) are commonly used in construction industry. A comparative study on effects of concrete properties when OPC of varying grades was partially replaced by SDA is discussed in this paper. Percentage replacement of OPC with SDA was 0, 10, 20, 30 and 40% respectively. Experimental investigations are carried out on mortar cubes, concrete cubes and beams specimens. The mix was designed for target cube strength of 30 MPa at 28 days with water-cement ratio of 0.38. The compressive strength, water absorption, shrinkage and durability of concrete were mainly studied. Test results shows that, inclusion of SDA cause little expansion due to low calcium content. Early strength development was observed to be about 50-60% of their 28 days strength. The study suggests the use of SDA as partial replacement of cement up to a maximum of 10% by volume in all grades of cement. Keywords - Sawdust Ash, ordinary Portland cement (OPC), partial replacement

III. MATERIAL & TESTS

A.GENERAL:- In this examination an endeavor has been made to think about the impact of CS, SW & PW on properties of concrete. 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.

CEMENT

PPC creates lessened warmth of hydration and that too at low rate. PPC being better than OPC and furthermore due to pozzolanic activity, it enhances the pore estimate appropriation and furthermore lessens the smaller scale splits at the progress zone. In this test work the Ordinary Portland pozzolana cement with 43 review affirming to Indian Standard IS12269-1987 was utilized.

Table .1 Composition of Ordinary Cement

Ingredients	Desired Range of Percentage
Lime (Cao)	62 to 67
Silica (SiO_2)	17 to 25
Alumina (Al_2O_3)	3 to 8
Calcium Sulphate ($CaSO_4$)	3 to 4
Iron Oxide (Fe_2O_3)	3 to 4
Magnesia (MgO)	0.1 to 3
Sulphur (S)	1 to 3
Alkalies	0.2 to 1

Coarse Aggregate

Machine crushed broken stone angular in shape was used as coarse aggregates. Two fraction of coarse aggregates were used, 20mm size having specific gravity of 2.85, and 10mm size having specific gravity of 2.85.

Fine Aggregate

The fine aggregates used in this investigation was Narmada River sand passing from 4.75 mm sieve having specific gravity of 2.64. The grading zone of fine aggregates was zone II as per Indian standard specification.

Blending water

Ordinary tape water which is clean, potable and free from suspended particles and chemical substances was used for

both mixing and curing of concrete.

SAW DUST

Sawdust is also known as wood dust. It is the by-product of cutting, drilling wood with a saw or any other tool; it is composed of fine particles of wood. Certain animals, birds and insects which live in wood, such as the carpenter ant are also responsible for producing the saw dust. Sawdust's are produced as a small discontinuous chips or small fragments of wood during sawing of logs of timber into different sizes. The chips flow from the cutting edges of the saw blade to the floor during sawing operation.

COPPER SLAG

Copper slag is a by-product of copper smelting and refining process. As refineries draw metal out of copper ore, they produce a large volume of non-metallic dust, soot, and rock. Copper slag which is an industrial waste obtained from smelting and refining process of copper from Sterlite Industry Ltd., Tuticorin, and Tamilnadu. Nearly 4 tons of copper is obtained as waste is disposed to lands cause's environmental impacts. So it can be reused as concreting materials. In refinery plants when copper metal produced by extraction process then copper slag is generated in a large amount in the production of copper metal. About 2-2.5 tons of copper slag produced for each 1 ton of copper production. Production of concrete has many environmental benefits for example waste recycling and resolve disposal problems. Concrete is wide utilized in the development of superior structures like high rise buildings, long-span bridges, etc. So, it must have higher workability, it has superior mechanical properties than those of typical concrete. In order to produce concrete with good mechanical properties, fly ash and silica fume that are assume as waste materials used one of the most constituent. Concrete production with that material gives upgrading in workability compared to traditional concrete.

PLASTIC WASTE

The word "electronic waste" means substances which have electronic wasteity, and accordingly, anything that is formed in a soft state and used in a solid state can be called a electronic waste. Therefore, the origin of electronic waste forming can be traced back to the processing methods of natural high polymers such as lacquer, shellac, amber, horns, tusks, tortoiseshell, as well as inorganic substances such as clay, glass, and metals. Because the natural high polymer materials are not uniform in quality and lack mass productivity in many cases, from early times it has been demanded in particular to process them easily and into better quality and to substitute artificial materials for natural high polymers. Celluloid, synthetic rubber, ebonite, and rayon are these artificial materials. Presently, it is defined that the electronic wastes are synthesized high polymers which have electronic wasteity, and consequently substances made of these natural materials are precluded.

IV. RESULT & DISCUSSION

4.1 CONSISTENCY OF CEMENT TEST

The basic aim is to find out the water content required to produce a cement paste of standard consistency as specified by the IS: 4031 (Part 4) – 1988. The principle is that standard consistency of cement is that consistency at which the Vicat plunger penetrates to a point 5-7mm from the bottom of Vicat mould. The control paste had normal consistency of 33%.

4.2 Workability of concrete

Table 2. Workability of Cement with Different Properties of Different Material

S.No.	Percentage of Variation	Slump in (mm) Contain Copper slag	Slump in (mm) Contain Saw dust	Slump in (mm) Contain Plastic Waste
1	0	75	75	75
2	15	77	85	90
3	30	85	115	105
4	45	105	125	110

4.3 Compressive Strength

Compressive Strength of M-30 concrete Mix contain Copper Slag at Different curing stages

The compressive strength of mortar for OPC were tested and analyzed. The average results of the laboratory tests for OPC-CS mortars are as discussed below:

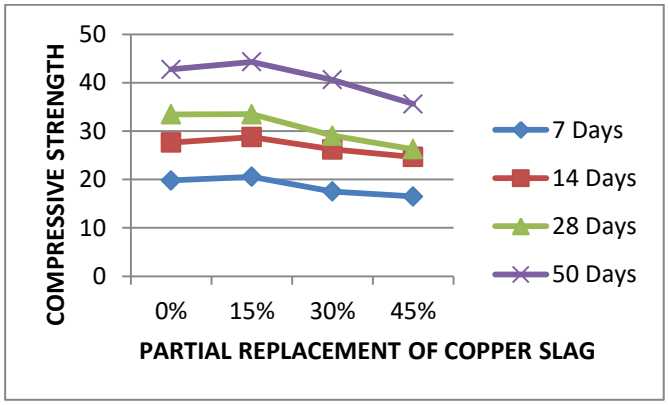

Figure 1: Compressive Strength of M30Grade Contain of CS

Compressive Strength of M-30 concrete Mix contain Saw Dust at Different curing stages

The compressive strength of mortar for OPC were tested and analyzed. The average results of the laboratory tests for OPC-SD mortars are as discussed below:

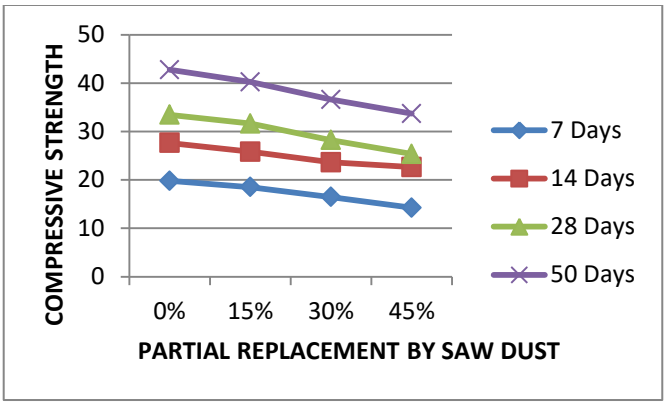

Figure 2: Compressive Strength of M30Grade Contain of SD

Compressive Strength of M-30 concrete Mix contains Plastic Waste at Different curing stages

The compressive strength of mortar for OPC were tested and analyzed. The average results of the laboratory tests for OPC-PW mortars are as discussed below:

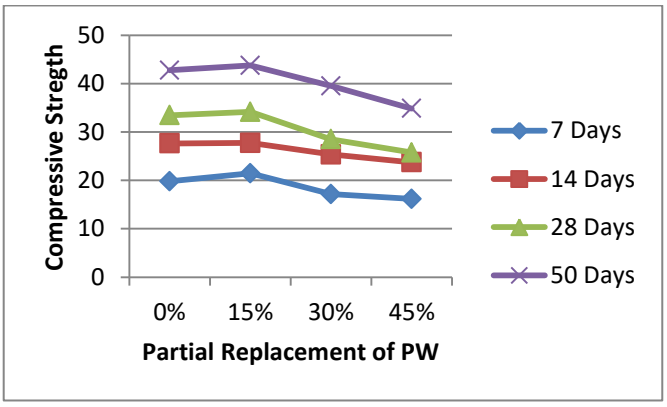

Figure 3: Compressive Strength of M30 Grade Contain of PW

4.4 SPLIT TENSILE STRENGTH TEST

The result of the Split tensile strength determine by compression testing machine, with the fractional replacement of CS, SW & PW by sand with level of 15%, 30% and 45% with result determine the age of 28 days are appeared in the fig. 11 for M-30 concrete.

Split Tensile strength of cylinder concrete contain CS, SW & PW

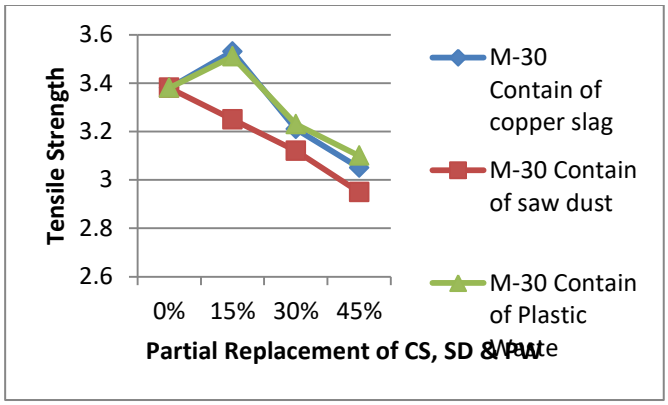

Figure 4:Split Tensile strength test results for M30

4.5 FLEXURAL STRENGTH TEST CONTAINING CS, SW & PW

Flexural power furthermore called as modulus of satisfaction. In solid flexure is the bowing moment brought about by the applied burden, wherein a solid pillar has pressure at top and elastic concern at the base side. Shafts on testing will bomb in strain in light of its property and shear will appear on concrete.

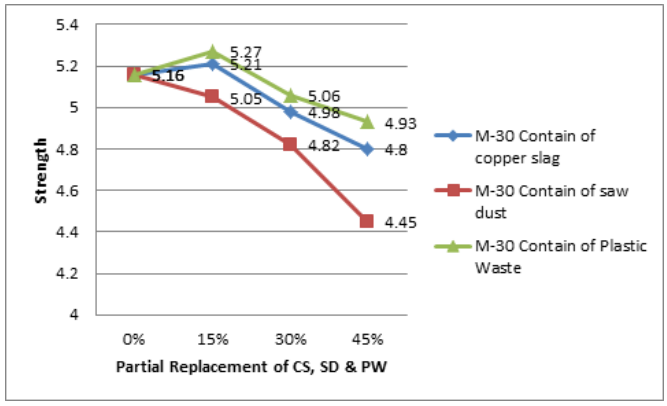

Figure 5 : Flexural Strength test results for M25

V. CONCLUSION

In this experimental study we have used CS, SD & PW as an alternative material for cement for M30 grade of concrete and from various tests on fresh and hardened concrete we have concluded following results:

- The study is based on the strength parameter and these are the governing criteria of research work there are basically three main strength parameters consider and the expected out are based on compressive strength, splite tensile strength test, flexure strength test.
- The basic aim is to find out the water content required to produce a cement paste of standard consistency as specified by the IS: 4031 (Part 4) – 1988. The principle is that standard consistency of cement is that consistency at which the Vicat plunger penetrates to a point 5-7mm from the bottom of Vicat mould. The control paste had normal consistency of 34%.
- From the above outcomes for slump demonstrates

that the workability diminishes with the expansion in the rates of 15, 30, and 45% of over CS, SD & PW with M-30 grade of concrete.

- The research is based on the partial replacement of sand by using CS, SD & PW, and is compare with the conventional concrete and replaced concrete.
- From the above outcomes It can be seen from Figure that Compressive Strength result at 7, 14, 28 and 50 days are higher than with 15% copper slag and lower than with the percentage of (30 to 45%) with the M-30 grade of concrete. The three cubes were specimens were tested using Compressive Strength machine. The outcome of compressive strength test and a variation in strength of cubes shows in graph.
- We can see that compressive Strength has decline with used as fragmentary substitution of sand by SD obstructs with the percentage of 15 to 30%, lower than show up especially in regards to the age of 7, 14, 28 and 50 days. we are comparison about 15 to 45 percentage, the we get 15% substitution are higher than 30 to 45% with the age of 7, 14, 28 and 50 days.
- From the above outcomes It can be seen from Figure that Compressive Strength result at 7, 14, 28 and 50 days are higher than with 15% PW and lower than with the percentage of (30 to 45%) with the M-30 grade of concrete. The three cubes were specimens were tested using Compressive Strength machine. The outcome of compressive strength test and a variation in strength of cubes shows in graph.
- We can see that Tensile Strength has increase with 15% utilized as fragmentary substitution of sand by copper slag & Plastic Waste and lower then 30 to 45% with M-30 grades of concrete and the age of 28 day.
- We can see that flexural Strength has increase with 15% utilized as fragmentary substitution of sand by copper slag & Plastic waste & lower then 30 to 45% with M-30 grades of concrete and the age of 28 day
- As per above observation the strength parameters seems to be decline but the target strength is achieve as per studies this strength is also satisfying the criteria for conventional concrete using ppc which is now a days in trend construction. so results are satisfactory as per cost optimization and industrial waste consumption for the production of 1 meter cube of concrete. 6000rs, 7054rs,7800rs and cost of replaced concrete are 4950rs, 5970rs, 6725rs respectively.

FUTURE SCOPES:

- This research was intended to discover the influence of copper slag, stone dust & Plastic Waste additions in concrete elements for M30 mixes.
- Copper slag, stone dust & Plastic Waste can be effectively replaced in concrete applications such as making bricks, hollow blocks and pavement blocks.
- While copper slag & Plastic Waste has higher shear strength value it can be used for soil stabilization.

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