Assessment of Improvement in Properties of M-45 Grade Concrete by Using Partial Replacement of Cement with Fly Ash and Coconut Shell Ash

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Abstract - **The environmental impact of Cement is significant because its production emits large amount of carbon dioxide. Utilization of industrial solid waste or secondary materials has been encouraged in construction field for the production of cement and concrete because it contributes for reducing the consumption of natural raw materials as resources. The volume of wastes generated in the world has increased over the years due to increase in population, socioeconomic activities and social development. One of the most attractive options of managing such wastes is to look into the possibility of waste minimization and re-use. The cost of cement used in concrete works is on the increase and unaffordable, yet the need for housing and other constructions requiring this material keeps growing with increasing population, thus the need to find alternative binding materials that can be used solely or in partial replacement of cement. The effect of coconut shell ash and fly ash has been investigated and the experiments have been done to utilize these waste materials with concrete. Agricultural waste material, in this case, coconut shells ash which is an environmental pollutant and Fly ash a waste generated by thermal power plants is as such a big environmental concern are used as a partial replacement of cement in concrete. The objective of this experimental study is to investigate the use of fly ash and coconut shell ash as partial replacement of cement for M-45 Grade concrete. The replacement levels of cement are 20%, 20%, 20% of fly ash and 10%, 15%, 20% of coconut shell ash. Compressive strength, Split tensile strength and Flexural strength are evaluated at 3,7and 28 days. This project evaluates how different contents of fly ash and coconut shell ash added to concrete may influence the concrete properties.**

keywords - **Coconut shell ash, Fly ash, Compressive Strength, Split Tensile strength and Flexural Strength.**

I. INTRODUCTION

Concrete is important construction material that has been widely used all over the world. The use of concrete has been increasing day by day. Due to some negative impacts are there in production of concrete such as coarse aggregate extraction from natural resources, scarcity of river sand it leads to depletion of materials and ecological imbalance. Utilization of industrial soil waste are secondary materials has been encouraged in construction field for the production of cement and concrete because it contributes to reducing the consumption of natural resources. Pollution arising during processing or from a not so well-proven technical performance of concrete using such materials should be taken into account before a concrete product using waste material aggregate can be assumed to be a better alternative. The stability and durability of products made of concrete using waste material over the expected life span is outmost importance, particularly in relation to building and structural applications. It is also necessary to aim establishing appropriate standard specifications wherever possible incorporating reliable method of test.

Many researchers have made efforts for preparing carbon black from agricultural by-products such as coconut shell sugarcane bagassa, nut shells, forest residues and tobacco stems. coconut shell is suitable for preparing carbon black due to its excellent natural structure and low ash content. Fly ash is a residual material of energy production using coal, which has been found to have numerous advantages for use in concrete. Some of the advantages include improved workability, reduced permeability, and increased ultimate strength, reduced bleeding, better surface and reduced heat of hydration. Several types of fly ash are produced depending on the coal and coal combustion process. It is a pozzolanic material and has been classified into two classes Fly ash is one of the residues generated in combustion, and comprises the fine particles that rise with the flue gases. Thus the agricultural waste like coconut shell ash and a industrial waste like fly ash can be used as partial replacement of cement in concrete. Using coconut shell ash and fly ash in replacement of cement in order to open our minds that there are things in our country that was suitable in our construction industry. It may decrease the cost of the resources that are being use in making with most likely the same quality.

II. OBJECTIVE

The objectives of this experimental assessment are

- To evaluate the compressive strength, Split tensile strength and flexural strength of concrete by partial replacement of cement with coconut shell ash and fly ash.
- Study on strength characteristics of M-45 grade concrete with replacement of 30%,35% and 40% by coconut shell ash and fly ash.
- To determine the % strength of concrete at 3 days,7 days and 28 days.

III. MATERIALS USED

- Cement
- Fine aggregate
- Coarse aggregate
- Fly ash
- Coconut shell ash

Cement

Cement has different properties and characteristics which depend upon their chemical compositions.By changing in fineness of grinding, oxide compositions cement have exhibit different properties and different kind of cement.The use of additives,changing chemical compositions and use of different raw materials have resulted in the availability of many types of cement .cement used in the experimental work is OPC (53 grade) conforming to IS:8112/1989.The physical properties and chemical properties of the cement obtained on conducting tests and the requirements as per IS:8112/1989.

Properties	***Results***
Specific gravity	3.12
Initial Setting Time	29 min
Final Setting Time	595 min

Fine Aggregate

The sand obtained from Krishna River near Vijayawada is used as fine aggregate in this project investigation. The sand is free from clayey matter, silt and organic impurities etc. The sand is tested for specific gravity, in accordance with IS: 2386-1963 and it is 2.719, where as its fineness modulus is 2.31. The sieve analysis results are presented in table. The sand confirms to zone-III Fine type of aggregate ought to comprise of common sand or squashed stone sand. The residue substance ought not to surpass 4% .

Properties	***Results***
Specific gravity	2.60
Sieve Analysis	Zone III
Water Absorption	1.0%

Coarse Aggregate

Machine crushed angular Basalt metal used as coarse aggregate. The coarse aggregate is free from clayey matter, silt and organic impurities etc. The coarse aggregate is also tested for specific gravity and it is 2.68. Fineness modulus of coarse aggregate is 4.20. Aggregate of nominal size 20mm and 10mm is used in the experimental work, which is acceptable according to IS: 383-1970.

Properties	***Results***
Specific gravity	2.68
Max size of Aggregate	20mm
Water Absorption	0.5%

Fly Ash

Fly ash is a residual material of energy production using coal, which has been found to have numerous advantage for use in concrete.some of the advantage include improved workability, reduced permeability, increased ultimate strength, reduced bleeding, better surface and reduced heat of hydration. Several types of fly ash are produced depending on the coal and coal combustion process. It is a pozzolanic material and has been classified into two classes Fly ash is one of the residues generated in combustion, and comprises the fine particles that rise with the flue gases. Ash which does not rise is termed bottom ash. In an industrial context, fly ash usually refers to ash produced during combustion of coal.

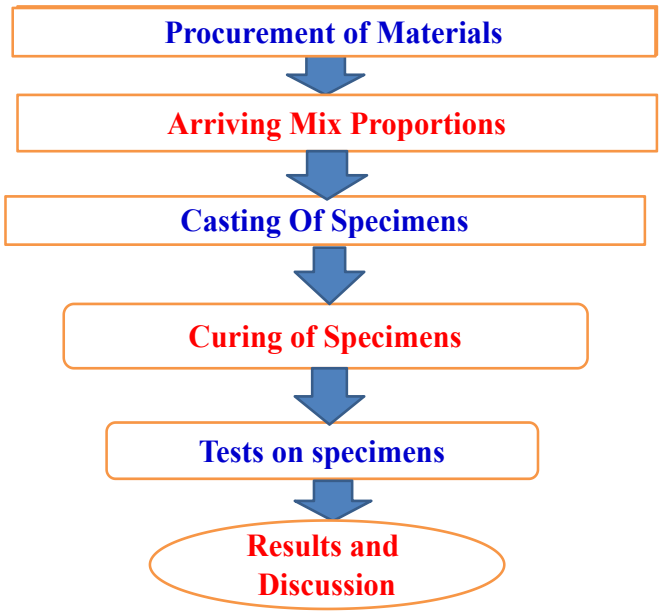
Properties	***Results***
Specific gravity	2.10
Color	Whitish Grey

Coconut Shell Ash

Coconut shell is one of the most important natural fillers produced in tropical countries like Malaysia, Indonesia, Thailand, and Sri Lanka. Many works have been devoted to use of other natural fillers in composites in the recent past years and coconut shell filler is a potential candidate for the development of new composites because they have high strength and modulus properties along with the added advantage of high lignin content. The high lignin content makes the composites made with these filler more weather resistant and hence more suitable for application as construction materials. Coconut shell flour is also extensively used to make products like furnishing materials, rope etc. The shells also absorb less moisture due to its low cellulose content the report focuses on studying the effectiveness of coconut shell particles as a source of natural material for reinforcing epoxy resins towards
their flexural properties.

Properties	*Results*
Specific gravity	2.50
Color	Black

IV. METHODOLOGY



V. TESTS CONDUCTED

The following tests were conducted during this experiment

- Sieve Analysis
- Specific Gravity for cement
- Specific Gravity for Fine Aggregate
- Specific Gravity for Coarse Aggregate
- Slump Cone Test
- Vee bee Consistometer Test
- Compressive Strength Test
- Split Tensile Strength Test
- Flexural Strength Test

VI. TEST RESULTS

Compressive Strength Test

The Average compressive strength at various proportions has tabulated below

S.No.	Replacement levels	Average Compressive Strength (Mpa)		
		3days	7 days	28 days
1	0	23.59	31.80	54.03
2	30	23.99	32.01	54.29
3	35	24.01	32.15	55.16
4	40	24.19	33.29	56.09

Split Tensile Strength Test

The Average Split Tensile strength at various proportions has tabulated below

S.No.	Replacement levels	Average Tensile Strength (Mpa)		
		3days	7 days	28 days
1	0	2.29	2.86	5.21
2	30	2.42	3.19	5.36
3	35	2.67	3.76	5.41
4	40	2.99	3.51	5.52

Flexural Strength Test

The Average Flexural strength at various proportions has tabulated below

S.No.	Replacement levels	Average Tensile Strength (Mpa)		
		3days	7 days	28 days
1	0	3.39	3.94	5.88
2	30	3.42	3.96	5.89
3	35	3.43	4.53	5.94
4	40	3.93	4.61	5.99

VII. CONCLUSION

- The compressive strength and tensile strength increases with increasing percentage replacement of Ordinary Portland Cement with Fly Ash & Coconut shell Ash.
- It can be seen that the average density decreases with increase in percentage replacement.
- Increase in workability by increase in replacement of Fly Ash & Coconut Shell Ash with Ordinary Portland Cement.
- Decrease in slump value by increase in replacement of Fly Ash & Coconut Shell Ash with Ordinary Portland Cement.
- CSA&FA/OPC mix showed some promise for use in reinforced concrete as well as mass concrete structures in building construction.

Based on experimental results,the use of coconut shell ash and fly ash as a partial replacement of cement is advantageous on the performance of concrete

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