STRENGTH EVALUATTION OF CONCRETE BY APPLICATION OF COCKLE SHELL AND ALUMINA REFINERY RESIDUE

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ABSTRACT

Concrete is the world's most versatile, durable and reliable construction material. Next to water, concrete is the most used material, which required large quantities of Portland Cement. In addition to that large amount energy was also consumed for the cement production. The major problem the world is facing today is the environmental pollution. In the construction industry mainly the production of Portland cement will causes the emission of pollutants results in environmental pollution. We can reduce the pollution effect on environment, by increasing the usage of industrial by-products in our construction industry. The research was conducted to study the properties of concrete by using alumina refinery residue 2% as replacement of cement in concrete. Various studies have been conducted on different waste products to determine the effectiveness of their use as a partial fine aggregate replacement in concrete.In this research, the effect of crushed cockle shell 10% as partial fine aggregate replacement material towards workability and compressive strength of concrete is tested.

Keywords: Concrete, Portland cement, Alumina refinery residue, Cockle shell, Fine aggregate.

INTRODUCTION

Concrete is the important material in the construction other than steel and timber. Its main constituents are cement, sand, fine and coarse aggregates, and water. As there are several wastes coming from the industries we can use those wastes as the constituents of concrete by replacing or partially replacing the cement, sand or aggregates which makes it economical and also conserves the natural resources. Nowadays many researchers are being carried out to find an alternative that could be used as a partial replacement of cement in concrete and mortar, since production of cement causes major environmental concerns. The cost of building construction is increasing daily as a result of increasing in the cost of building materials such as cement, coarse and fine aggregates etc.Concrete is the most popular building material in the world construction alumina refinery residue and cockle shell has been used raw material. The alumina refinery residue and cockle shell partial replacement of cement and fine aggregate in concrete it can helped in reducing the amount of CO2 emission emitted during cement production . On the other hand, the abundant availability of alumina refinery residue worldwide creates opportunity to utilize this by-product of production of alumina, as a substitute for OPC to manufacture concrete. Concrete usage around the world is second only to water. Ordinary Portland cement (OPC) is conventionally used as the primary binder to produce concrete. The

environmental issues associated with the production of OPC are well known. The amount of the carbon dioxide released during the manufacture of OPC due to the calcination of limestone and combustion of fossil fuel is in the order of one ton for every ton of OPC produced. In addition, the extent of energy required to produce OPC is only next to steel an aluminum.

MATERIALS

Cement and Aggregates

The OPC is classified into three grades, namely 33 Grade, 43 Grade, 53 Grade depending upon the strength of 28 days. Ordinary Portland Cement (OPC) of 53 Grade (RAMCO cement) from a single lot was used throughout the course of the investigation. The physical properties of the cement as determined from various tests conforming to Indian Standard IS: 8112:1989

Physical Properties of Fine and Coarse Aggregate

Description	**Fine Aggregate**	**Coarse Aggregate**
Specific gravity	2.6	2.75
Water absorption	1.57%	2.3%
Fineness modulus	3.1(zone II)	6.4
Surface moisture	Nil	Nil
Bulk density	1450 kg/m^3	1765kg/m^3

Mineral composition of cockle shell

Components	**Percentage%**
Cac	98.7
Mg	0.05
Na	0.9
P	0.02
Others	**0.2**

Composition of alumina refinery residue

Components	**Percentage%**
Al2O3	20-22
Fe2O3	40-45
SiO2	12-15
TiO2	1.8-2.0
CaO	1.0-2.0
Na2O	4.0-5.0

SPECIMEN PREPARATION

Preparation of mould: The compressive strength of the concrete were determined by cubes of size 150mmx150mmx150mm, split tensile strength of the concrete were determined by cylinders of size 150mmx300mm and flexural strength of the concrete were determined by prism of size 500mmx100mmx100mm. So the mould of such size prepared with water tight and oil applied to ease of demoulding before casting of concrete.

Mixing of concrete: Thorough mixing of materials is essential for the production of uniform course. The mixing should ensure that the mass becomes homogeneous, uniform in colour and consistency. The mixing was done by hand mixing of coarse aggregate and cement, adding water at appropriate of mixing.

Casting and compaction of concrete: After mixing, the moulds are filled immediately by pouring the concrete inside manually by using trowel with three layers. Compaction of concrete is process adopted for expelling the entrapped air from the concrete. In the process of mixing, transporting and placing of concrete air is likely to get entrapped. Compaction is done here is manually with slump test rod in the way of dispersing the homogeneous mix to avoid entrapment of air. Not strong blows as for as for

strong concrete is given, blows of 10-15 numbers are given for three layer. During compaction the strokes should be distributed in a surface of concrete, and should not forcibly strike the bottom of the mould. After the top layer has been compacted, a strike off bar is used to strike out the excess concrete. The finishing is done with the trowel by tapping the top surface.

Demoulding: The cubes, cylinders and beams specimens are demoulded after 24 hours from the process of moulding. Then the process must be delayed for another 24 hours care should be taken not

Mix	Average Compressive Strength of Concrete	
	At 7 days in N/mm^2	At 28 days in N/mm^2
Mix 0	24	34.8
Mix 1	27.6	35.18
Mix 2	27.96	37.47
Mix 3	29.15	38.39
Mix 4	30.34	38.42
Mix 5	30.02	38.39

to damage the specimen during the process because, if any damage is caused, the strength of the concrete may get reduced. After demoulding, specimen is marked with a legible identification, on any of the faces by using paint.

Curing: After demoulding of specimen, the cubes, cylinders and prism are placed inside the water tank conveniently for curing take place with identification mark.

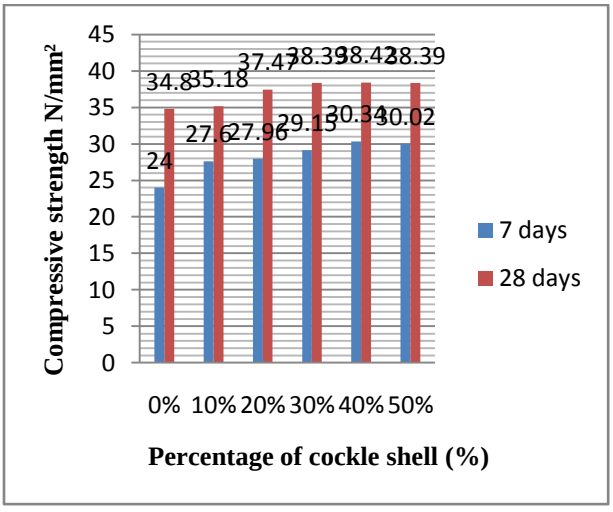
MIX DESIGN, RESULT AND DISCUSSION

Mix Design

Materials	Mix1	Mix2	Mix3	Mix4	Mix5
Cement	98%	98%	98%	98%	98%
Fine Aggregate	90%	80%	70%	60%	50%
Coarse Aggregate	100%	100%	100%	100%	100%
Cockle shell	10%	20%	30%	40%	50%
Alumina refinery residue	2%	2%	2%	2%	2%

COMPRESSIVE STRENGTH TEST RESULTS

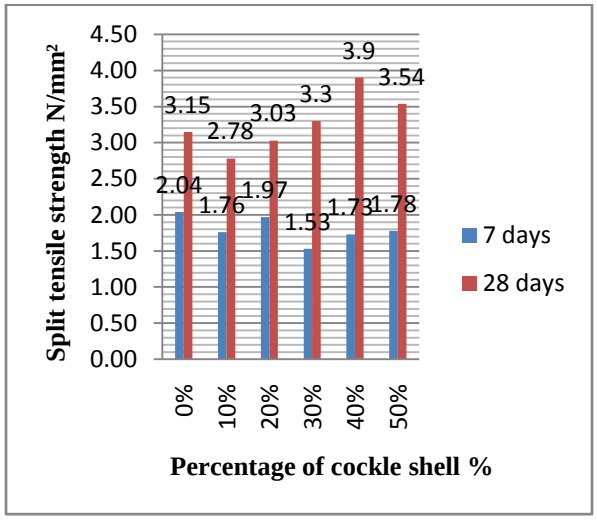
Compression test is the most common test conducted on hardened concrete, partly because it is an easy test to perform, and partly because most of the desirable characteristics properties of concrete are qualitatively related to its compressive strength. The compressive test is carried out on specimens cubical or cylindrical in shape. The cube specimen is of the size 15 x 15 x 15 cm.



SPLIT TENSILE STRENGTH TEST RESULTS

Cylinder is of diameter 15 cm and 30 cm height.

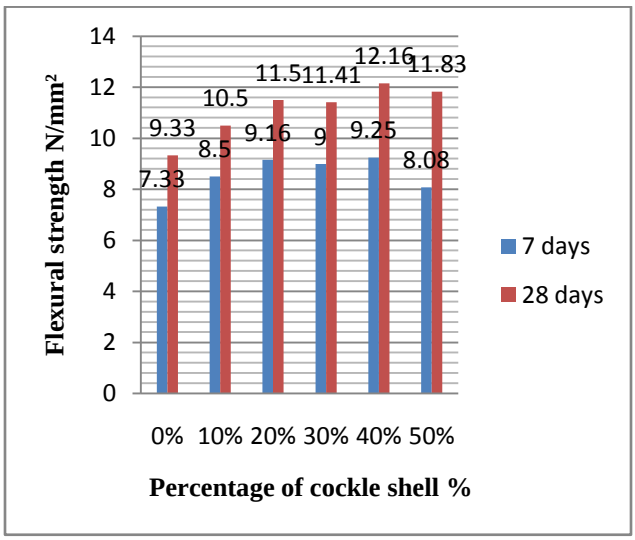
Mix	Average split tensile Strength of concrete	
	At 7 days in N/mm^2	At 28 days in N/mm^2
Mix 0	2.04	3.15
Mix 1	1.76	2.78
Mix 2	1.97	3.03
Mix 3	1.53	3.30
Mix 4	1.73	3.9
Mix 5	1.78	3.54



FLEXURAL STRNGTH TEST RESULT

Flexural test is the most common test conducted on hardened concrete, partly because it is an easy test to perform, and partly because most of the desirable characteristics properties of concrete are qualitatively related to its Flexural strength. The beam specimen is of the size 1200 x 150 x 100 mm .

Mix	Average Flexural Strength of concrete	
	At 7 days in N/mm^2	At 28 days in N/mm^2
Mix 0	7.33	9.33
Mix 1	8.5	10.5
Mix 2	9.16	11.5
Mix 3	9	11.41
Mix 4	9.25	12.16
Mix 5	8.08	11.83



CONCLUSION

COMPRESSIVE STRENGTH ANALYSIS

From the compression test results it is found that the concrete mix with replacement of cement with alumina refinery residue shows the higher compressive strength than the Reference concrete mix for both 7 days and 28 days curing.

From the experimental analysis, it is concluded that alumina refinery residue mix, which is replacement of alumina refinery residue, is found to be the most preferable one when compared with other mixes by analyzing its Compressive strength, Workability and

Cost. It is recommended as favourable mix for both Structural and Non- Structural applications.

SPLIT TENSILE STRENGTH ANALYSIS

From the split tensile test results it is found that the concrete mix with replacement of cement with alumina refinery residue shows the higher compressive strength than the Reference concrete mix for both 7 days and 28 days curing.

From the experimental analysis, it is concluded that alumina refinery residue mix, which is replacement of cement, is found to be the most preferable one when compared with other mixes by analyzing its split tensile strength ,Workability and Cost. It is recommended as favourable mix for both Structural and Non- Structural applications.

FLEXURAL STRENGTH ANALYSIS

From the flexural test results it is found that the concrete mix with replacement of cement alumina refinery residue shows the higher compressive strength than the Reference concrete mix for both 7 days and 28 days curing.

From the experimental analysis, it is concluded that alumina refinery residue mix, which is replacement of alumina refinery residue, is found to be the most preferable one when compared with other mixes by analyzing its flexural strength, Workability and Cost. It is recommended as favourable mix for both Structural and Non- Structural applications.

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