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To Increase The Strength Of Concrete By Adding Seashell As Admixture

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1,INTRODUCTION

1.1 GENERAL :

As concrete is ubiquitous and its history can be traced to ancient Egypt and Rome, it is often falsely perceived as a "simple" material. Actually, the microstructure of concrete tends to be highly complex. Moreover, the structure and the properties of this composite material can change over time. Most modern concrete structures are reinforced with steel, since concrete itself displays relatively low strength when loaded in tension. While steel reinforced concrete is obviously a widely used, cost-effective construction material, degradation of such structures has become a major problem in many parts of the world.

The basic constituents of concrete are **cement, water and aggregate** (and selected additives).

- **Cement** is produced by heating limestone and clay to very high temperatures in a rotating kiln. Cement is produced by grinding the resulting clinker to a fine powder.
- **Water** reacts chemically with cement to form the cement paste, which essentially acts as the "glue" (or binder) holding the aggregate together. The reaction is an exothermic hydration reaction. The water cement ratio is an important variable that needs to be "optimized". High ratios produce relatively porous concrete of low strength, whereas too low a ratio will tend to make the mix unworkable.
- **Aggregate**s are usually described as inert "filler" material of either the fine (sand) or coarse (stone) variety. Aggregate tends to represent a relatively high volume percentage of concrete, to minimize costs of the material.

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1.2 Materials

1.2.1 Fly ash:

Fly ash is also known as flue-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. Fly ash is generally captured by electrostatic precipitators or other particle filtration equipment before the flue gases reach the chimneys of coal-fired power plants, and together with bottom ash removed from the bottom of the furnace is in this case jointly known as coal ash. Toxic constituents depend upon the specific coal bed makeup, but may include one or more of the following elements or substances in quantities from trace amounts to several percent: arsenic, beryllium, boron, cadmium, chromium, hexavalent chromium, cobalt, lead, manganese, mercury, molybdenum, selenium, strontium, thallium, and vanadium, along with dioxins and PAH compounds.In the past, fly ash was generally released into the atmosphere, but pollution control equipment mandated in recent decades now require that it be captured prior to release. In the US, fly ash is generally stored at coal power plants or placed in landfills. About 43% is recycled, often used to supplement Portland cement in concrete production.

1.2.2 Seashell:

Seashell is also known simply as a shell, is a hard, protective outer layer created by an animal that lives in the sea. The shell is part of the body of the animal. Empty seashells are often found washed up on beaches by beachcombers. The shells are empty because the animal has died and the soft parts have been eaten by another animal or have rotted out. The term seashell usually refers to the exoskeleton of an invertebrate (an animal without a backbone). Most shells that are found on beaches are the shells of marine molluscs, partly because many of these shells endure better than other seashells. Seashells have been used by humans for many different purposes throughout history and pre-history. However, seashells are not the only kind of shells; in various habitats it is possible to find shells from freshwater animals such as freshwater mussels and freshwater snails, and it is also possible to find the shells of land snails. Seashell consists of three layers outer, intermediate and inner layer .Outer layer is made up of calcite material where as inner layer is otherwise known as nacre which is made up of calcium carbonate .since 95% of calcium carbonate present in seashell; it has the strength nearly equal to coarse aggregate.

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2,SCOPE AND OBJECTIVE

2.1 Objective:

To compare the strength of concrete specimen made by conventional method with that of specimens made by replacing cement partially with fly ash to 25% and coarse aggregate with seashell to 10%, 20% and 30% by weight.

2.2 Scope :

- To provide an economical concrete.
- To be easily adopted in construction field.
- To use the wastes in useful manner.
- To reduce the demand of cement.
- To improve the durability of the concrete.
- To reduce the cost of the construction.
- To find the optimum strength of the partial replacement of concrete.
- To minimize the maximum demand for cement and coarse aggregate.
- To Minimize the maximum degradation in environment due to cement And safeguard the ozone layer from green house gases.

3,EXPERIMENTAL STUDIES

The selection of the materials used for the casting of the cubes , beams and cylinders have been done based on basic preliminary tests that are conducted and compared to the criteria as stated in their respective codes. The tests that have been performed on the materials and their results are listed below under their respective material chapters.

3.1 Cement:

The most common cement used is an ordinary Portland cement. The Ordinary Portland Cement of 53 grade conforming to IS: 12269-1987 is been used. Many tests were conducted on cement; some of them are Specific gravity, setting tests, etc.

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3.1.1 Specific gravity test :

The specific gravity of cement is tested for design mix. The test result shows that specific gravity of cement is 3.157 which is in the range between 3.15 to 3.25 as per code IS 12269 – 1987.

3.1.2 Consistency test:

The aim of this test is to find out the consistency of the given cement sample. This test is performed using Vicat apparatus and a Vicat plunger. About 500 g of cement is taken mixed in mould with water and the settlement of plunger in mm after 30 seconds is measured. The consistency of the given sample was observed to be 28%.

3.1.3 Setting time test:

The aim of this test is to find out the initial and final setting time of the cement sample used for the casting. This test is done using Vicat apparatus and a Vicat needle. About 500g of cement with the percentage of water required for normal consistency is used. The specimen is placed in moist room for 30 minutes then the needle was released and the settlement of needle is measured. The Initial setting time was 27 minutes and the Final setting time was 535 minutes. .

3.2 AGGREGATE:

The size of aggregates used is 20mm and the grain size of sand used is of zone 2. The aggregate tests are performed and the results are as follows.

3.3 SIEVE ANALYSIS:

The sieve analysis test is performed to obtain a distribution of grain size of the aggregate. The test was performed for 20mm aggregates , river sand and seashell for the project.

Fine aggregate:

Fine sand : 2.2 – 2.6

Medium sand: 2.6 – 2.9

Coarse sand: 2.9 – 3.2

From IS 2386 – 1963 , it is clear that fine aggregate is fine sand.

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The graph below shows the zone of fine aggregate :

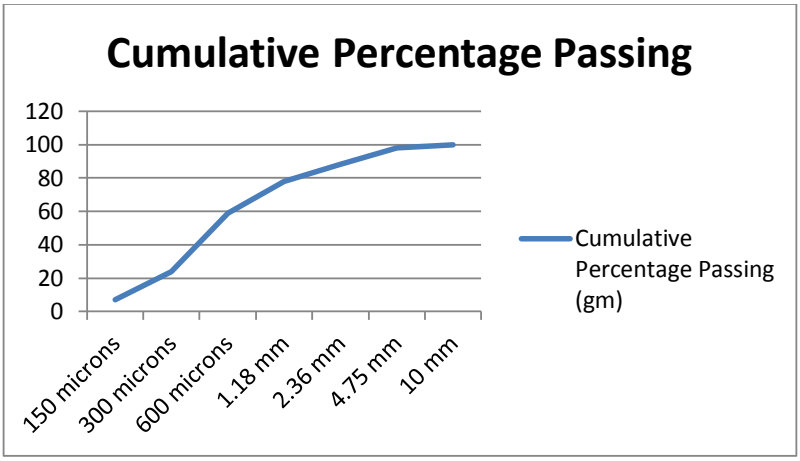
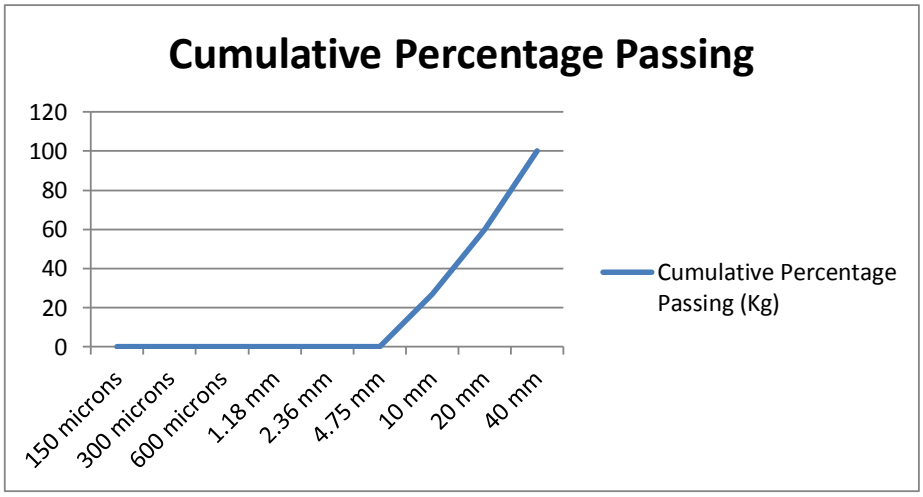


Fig. Sieve analysis of Fine aggregate.

Comparing the above graph with ranges given in IS 383 – 1970, fine aggregate comes under Zone – II.

Coarse aggregate:

The sieve analysis for coarse aggregate is executed to find out the aggregate size and its zone. The fractions from 80 mm to 4.75 mm are termed as coarse aggregate. The Coarse Aggregates from crushed Basalt rock, conforming to IS 383 – 1970 is been used.The analysis is done with 5 Kg of coarse aggregate by manual sieve shaker for about 15 minutes with the sieve dishes are arranged from 40 mm to 150 microns down the order of sieve shaker. Based on the analysis, the fineness modulus obtained as 7.132 which is in zone



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4,SEASHELL

4.1 Seashell

Seashell is a waste obtained near the seashore area as the result of disintegration of dead animals. Seashell consists of three layers outer, intermediate and inner layer .Outer layer is made up of calcite material whereas inner layer is otherwise known as nacre which is made up of calcium carbonate. since 95% of calcium carbonate present in seashell , it has the strength nearly equal to coarse aggregate.

The sieve analysis for seashell is executed to find out its size. The analysis is done with 500 grams of seashell by manual sieve shaker for about 15 minutes with the sieve dishes are arranged from 40 mm to 1.18 mm down the order of sieve shaker. Based on the analysis, the fineness modulus obtained as 7.53.

4.2 Water absorption test:

This test is performed in order to determine the water absorption capacity of the aggregates used. Here about 300 grams of the various aggregates are taken separately and immersed in water for about 24 hours. These aggregates are then kept in oven at a temperature of 100 to 110 C° for a time period of 6 hours and then sample is weighted. The change in weight is noted. As per code the limiting value for the water absorption is 2%. The results of the aggregates tested are 1% for sand, 0.5% for 20mm aggregates and 0% for seashell.

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4.3 Specific gravity test:

This test is done to determine the specific gravity value of the aggregates used. It is done using pycnometer bottle. The test for the river sand, 20mm aggregates and seashell are performed separately. The specific gravity values obtained is as follows :

FINE AGGREGATE : 2.51

20mm AGGREGATE : 2.67

SEASHELL : 2.50

Fig Specific gravity test of seashell

4.4 Concrete:

The grade of concrete chosen is M20 Grade and the proportion of the mix is calculated as per the mix design . The concrete selection criteria tests performed are mentioned below.

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4.4.1 Slump test:

The aim of this test is to determine the workability of the cement concrete to be used. The mix is prepared and placed in a clean slump cone mould and tamped by three layers of about 25 stokes each layer and the top of the cone is levelled off. Then the mould is lifted up vertically and the nature of slump is analyzed to get the workability of the given cement concrete . For the water cement ratio of 0.5 the slump obtained for each seashell concrete design mix and conventional design mix are given below (in mm):

Conventional concrete : 27

10 % replacement of seashell : 29

20 % replacement of seashell : 33

30 % replacement of seashell : 35

The above slump value are within the permissible limit as per IS code 456 and suitable for construction purpose and also has a good workability.

4.5 Experimental procedure:

Once the preliminary tests are performed and checked for the quality of the material , casting of mould such as cube , beam, cylinder is the next process. The moulds are casted for different proportions such as conventional concrete , 10% , 20% , 30% coarse aggregate replaced seashell concrete. Based on the design mix , the required quantity of the material for

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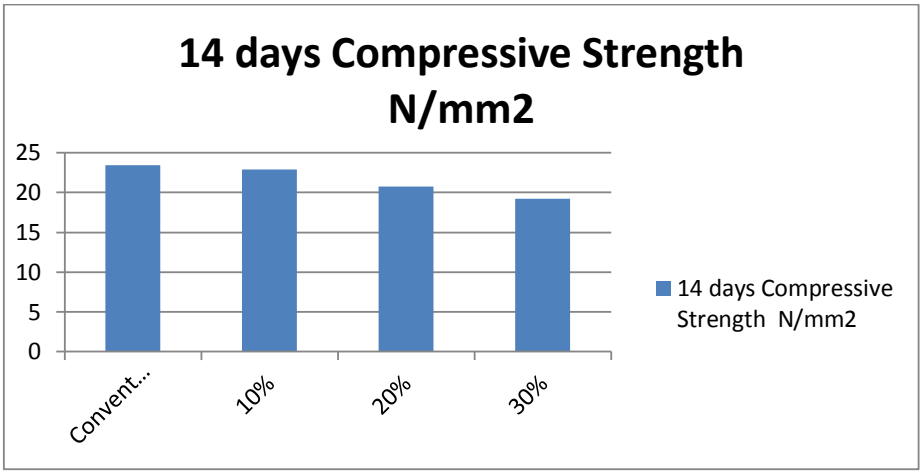
the different types of mould is taken and concrete is made for the water cement ratio of 0.5. After mixing the concrete perfectly and then the concrete is placed in the moulds and allowed for setting. Later they are demoulded and placed in the curing tank for the curing process to take place.

4.5.1 Compressive strength of concrete cubes:

This test is done to determine the cube strength of concrete mix prepared. The test is conducted on the 14th day and the 28th day and its observation are listed below in the form of a graph.

The load is given gradually and the point where the cube fails is noted and it is taken as the load at which failure occurs.

GRAPH OF COMPRESSIVE TEST: 14 DAYS COMPRESSIVE STRENGTH :



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