Evaluating The Possibilities of Partial Replacement of Fine Aggregate With Seashell Powder on Properties Of Natural Fiber Reinforced Concrete

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Abstract- *The environmental and economic concern is that the biggest challenge the concrete trade is facing, the problems of environmental and economic concern are self-addressed by the utilization of seashell powder as partial replacement of fine aggregates in concrete. Fine aggregates will be replaced by seashell powder as 10%, 20%, 30% and 40% weight for M-20 mix. The concrete specimens will be tested for compressive strength at 7, 14 and 28 days respectively and also the results obtained will be compared with those of conventional concrete. Seashell powder utilized in concrete creating ends up in the greener setting. Utilization in concrete is a motivating risk for the economy on waste disposal sites and conservation. On the other side as the concrete weak in tension and strong in compression sisal fibers are added to the optimum content of seashell powder. This project examines the likelihood of utilization of seashell in fine mixture replacement in concrete. Natural sand will be part replaced (0% - 40%) with seashell in concrete. Compressive strength up to 28 days respectively will be compared with those of control mix created with natural sand. This Study describes the feasibility of using the seashell powder in concrete as fine aggregate replacement and detecting workability, compressive strength and tensile strength on comparison with conventional concrete.*

Keywords- Seashell powder, Sisal fibre, Compressive strength, split tensile strength test, flexural strength test.

I. INTRODUCTION

Concrete is composite material which consists of portland cement, coarse aggregate, fine aggregate ad water in required proportions. Concrete is is one of the most popular building materials in the world which used for the purpose of construction in now days. Due to its composite nature concrete is weak in tension but strong in compression. Basic Principle involved in the increase in strength of concrete is heat of Hydration. The desired physical characteristics of the finished material can be achieved by including additives and reinforcement portland cements in the mixture. Rapid industrial expansion produces severe difficulties all around the world, including as the depletion of natural resources and the creation of vast amounts of waste materials throughout the manufacturing, construction, and demolition stages; one option to mitigate this problem is to utilize wastes. The fresh concrete must be composed to achieve the desired hardening and hardening state performance. The use of palm oil fuel ash waste as a partial replacement for cement in concrete has been found to improve microstructure features, potentially improving strength, durability, and surface quality.

The main objective of the present study is to know the influence of seashell powder and sisal fibreon properties of concrete and detecting workability, compressive strength, flexural and tensile strength on comparison with conventional concrete M20 grade concrete.

II. REVIEW OF LITERATURE

This part of the study deals with the review of several research papers related to compressive strength and workability of concrete poised by employing various source materials such as fly ash, zeolite etc. But considering availability of material and cost considerations many researchers studied various properties of concrete are given below.

Experimental Study on Usage of Seashell as Partial Replacement for Sand in Concrete by I.J Karthick, R.Jeyanthi , M Petchiyammal et al.,(2014)

In this paper the strength properties of concrete is evaluated by replacing the cement and coarse aggregate with minimum percentage of seashell powder rice husk ash, silica fumes and fly ash to obtain optimum strength of concrete.

4. Partial replacement of fine aggregate by rice husk ash and seashell powder by Dinesh. N , Ramesh Kumar P, Arunachalam et al.,(2001)

This study helps to increase the strength of concrete by replacing the cement with sugarcane ash, fly ash ,sisal fibre and some of the other natural byproducts.

5. Experimental Study on Partial Replacement of Cement with Seashell Powder by Praveen Kumar R et al.,(2015)
The Seashell usually which are disposed, is used as an alternate for the cement since the shell is made up of Calcium.

A combination of Seashell with silica fumes are used in different combinations to find the feasibility of using the Seashells as an alternate to cement Seashell powder replaces 10%, 20% and 30% in addition with the silica fume by 5%, 10%, 15% of weight of cement.

6. Mechanical Properties of concrete by using Seashells with Partial Replacement of Fine Aggregate by M Bhuvaneshwari et al.,(2018)

The present research design to check the workability and strength of seashells by using with partial replacement of seashells fine aggregate. This work has investigated the potential use of used seashells as a concrete material. The seashells mixed with 0%,5%,10%,15%,20%,25% replacement level. It is addiction of seashells in mix design to find the workability like slump cone and hardened concrete to like Compressive Strength ,Split Tensile Strength and Flexural Strength of the concrete .To compare the strength between the partial replacement of seashells aggregate concrete and conventional concrete. The results shows that 20% of seashells aggregate add gives efficient results when compared to other percentage and conventional concrete.

7. Effects of Partial Replacement of Fine Aggregate with Sisal fibre on Concrete Properties by Ajamu S. O., Raheem I A., Attah S.B., Onika J.O et al.,(2020)

In the present study, experiments were carried out to study the gradation of aggregates, workability, compressive strength and split tensile strength of concrete made using sisal fibre as replacement of fine aggregate at 0, 25, 50, 75, and 100%. Grade M25 of concrete was prepared for compressive strength and split tensile strength concrete. Workability and Compressive strength were determined at different replacement level of fine aggregate and optimum replacement level was determined based on compressive strength. Results showed that by replacing 50% of fine aggregate with sisal fibre, concrete of maximum compressive strength can be produced as compared to all other replacement levels.

The concept of replacement of natural fine aggregate by sisal fibre could boost the consumption of sisal fibre generated from the quarries. Sisal fibre satisfies the reason behind the alternative material as a substitute for sand at very low cost. From the experimental results it is concluded that the sisal fibre can be used as the replacement for fine aggregate. It is found that 40%replacement of fine aggregate by sisal fibre gives maximum result in strength.

III. MATERIALS AND METHODS

The experimental investigation work is started with various tests on the constituent materials. The constituent materials are given below.

1. Cement
2. Coarse aggregate
3. Water
4. Fly ash
5. Metakaolin.
6. Super plasticizer

Cement

Ordinary Portland Cement (OPC) was used in the experimental work which is conforming to I.S 4031-1988.The O.P.C is classified into three grades, those are 33grade, 43grade and 53 grade, depending upon the strength of the cement in this experiment 43grade cement is used.

Fine Aggregate

Fractions from 4.75 mm to 150 microns are termed as fine aggregate. Locally available river sand passed through 4.75mm IS sieve is applied as fine aggregate conforming to the requirements of IS 383:1970.

Coarse Aggregate

The crushed aggregates used were of 20mm nominal maximum size.Aggregate most of which is retained on 4.75-mmIS Sieve and containing only so much finer material as is permitted for the various types described in this standard.

Seashell Powder

The Seashells acquired from waterfront territories are smashed and powdered. Specific gravity of seashell powder is 2.27 and fineness modulus is 1.37. Refer Table 3.1 for chemical composition..

Sisal fibre

The Sisal is a hard fibre derived from the leaves of the sisal plant . Sisal is a completely biodegradable and highly renewable energy resource. The material is chosen to enhance the various strength properties of the structure in order to achieve durability and a higher quality structure. There are three types of sisal fibres, arch fibres, conductive fibres and structural fibres. The structural fibres are often taken out of because of their toughness as they do not break during the extraction process. The structural fibres are often taken out of because of their toughness as they do not break during the extraction process. Such fibres are of good tensile strength. Such fibres are of strong tensile strength or tensile strength. They are very resistant against heat. Across developing countries, sisal fibres are used as reinforcement in houses.

V. TESTS ON FRESH CONCRETE

WORKABILITY OF CONCRETE

It is the important property of fresh concrete which gives the behavior of concrete from mixing to compaction. The workability of concrete is the most complex property, which is difficult to define and measure. A concrete which has high consistency and which has high consistency and which is more workable, need not be of right workability for a particular job. Every job requires a particular workability.

The vertical settlement of unsupported fresh concrete, flowing to the sides and sinking in height is known as slump. Slump is a measure indicating the consistency or workability of cement concrete.

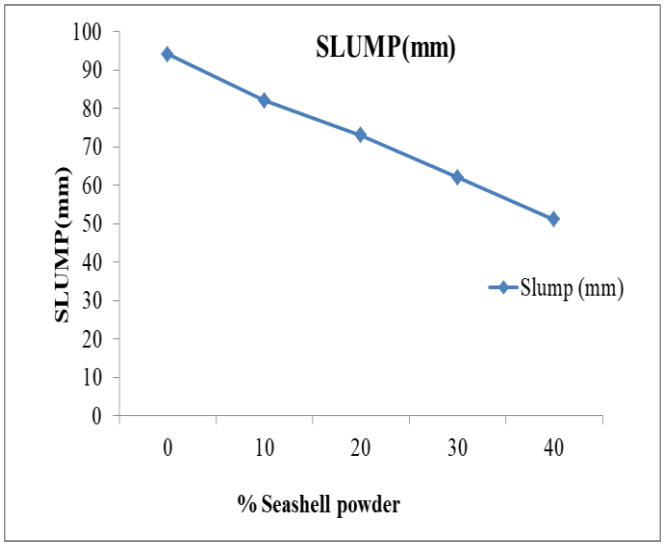

Fig 5.1: Slump values of M20 grade of concrete with % replacement of seashell powder

VI. TESTS ON HARDENED CONCRETE

6.1 VARIATION OF COMPRESSIVE STRENGTH FOR DIFFERENT MIXES

Compressive strength of concrete replaced with palm oil fuel ash for curing period of 7-days, and 28-days respectively and figure shows the summarized Compressive strength Results for different curing periods– M20 grade.

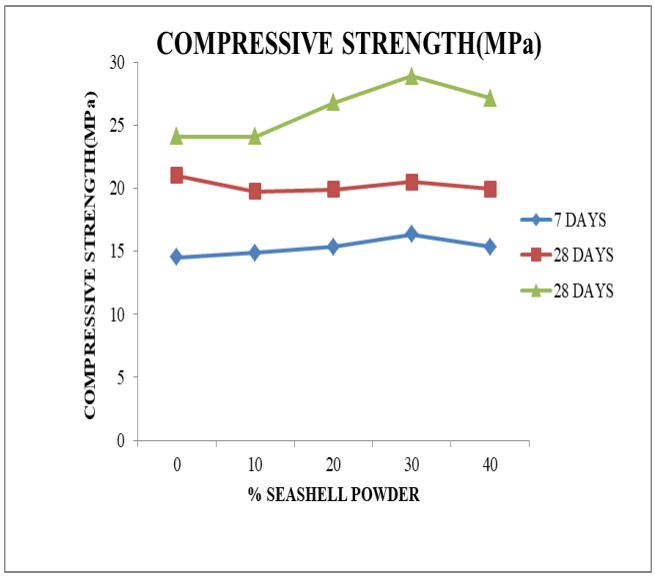

Fig 5.3: Effect of seashell powder on compressive strength of concrete at 7 days, 14 days and 28 days curing

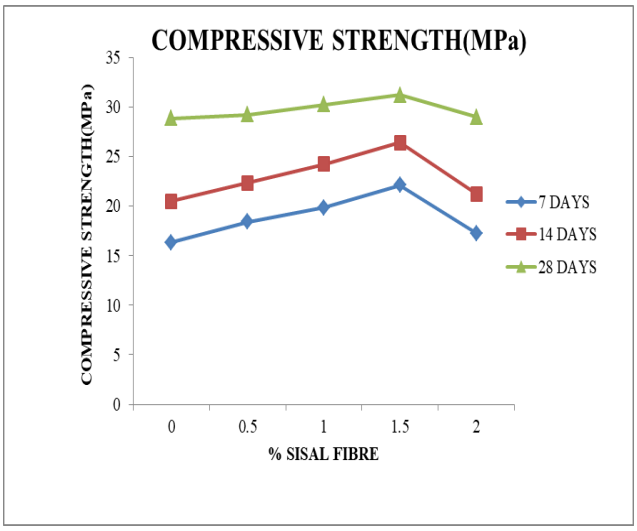

Fig 5.4: Effect of sisal fibre on compressive strength of concrete at 7 days and 28 days curing

6.2VARIATION OF SPLIT TENSILESTRENGTH FOR DIFFERENT MIXES

The cylinder specimen is of the size 150 mm diameters and 300mm height was cast to determine the split tensile strength of concrete. The test is carried out by placing a cylindrical specimen horizontally between the loading

surfaces of compression testing machine and the load is applied until failure of cylinder, along its longitudinal direction. The cylinder specimens are tested at 7 days and 28 days. The average of three specimens was reported as the split tensile strength provided the individual variation is not more than 15% of average value.

Split tensile strength =2P/πDL

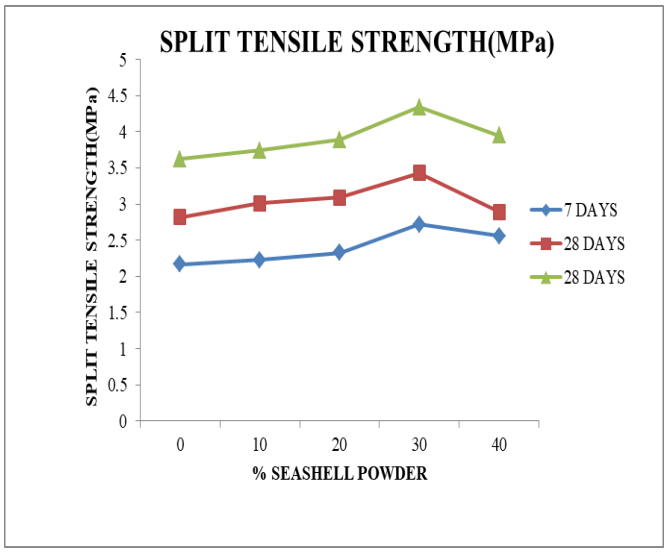

Fig 5.5 Effect of seashell powder on Split tensile strength of concrete at 7 days, 14 days and 28 days curing

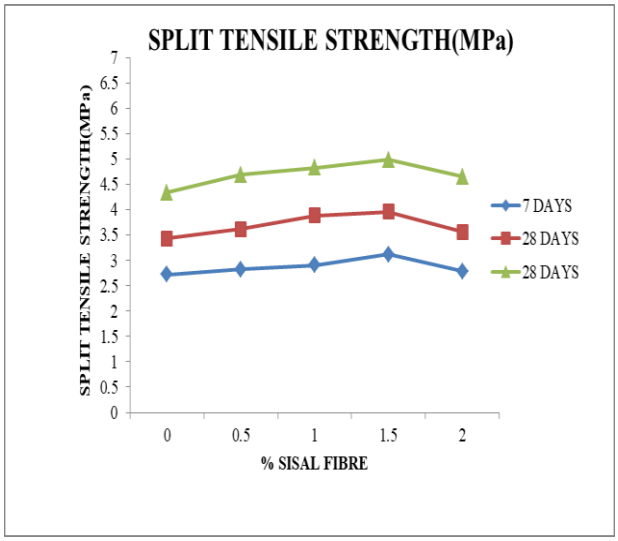

Fig 5.6 Effect of sisal fibre on Split tensile strength of concrete at 7 days, 14 days and 28 days curing

6.3 VARIATION OF FLEXURAL STRENGTH FOR DIFFERENT MIXES

Tensile stress is developed in concrete due to drying shrinkage, rusting of steel reinforcement, temperature gradient and many other reasons. Therefore, the knowledge of tensile strength of concrete is important. We measure the tensile strength of concrete in indirect method like flexural test. In flexural test we find the modulus of rupture (extreme fibre stress in bending), this value depends up on the dimension of beam manner of loading. In the flexural test two types of loading conditions, there are central point loading, third point loading. In our experimentation use third point loading with a size of beam is 70 x 15 x 15 cm. this test performed as per IS: 516 code.

Flexural strength of concrete with different percentages of seashell powder for curing period of 7-days, 14-days, 28-days respectively and Table 6.7 shows the summarized results for flexural strength of concrete for different percentages of seashell powder at different curing periods.

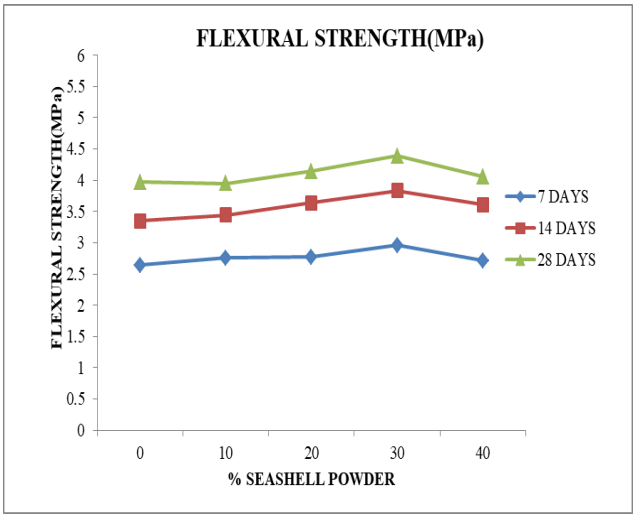

Fig 5.7 Effect of seashell powder on flexural strength of concrete at 7 days, 14 days and 28 days curing

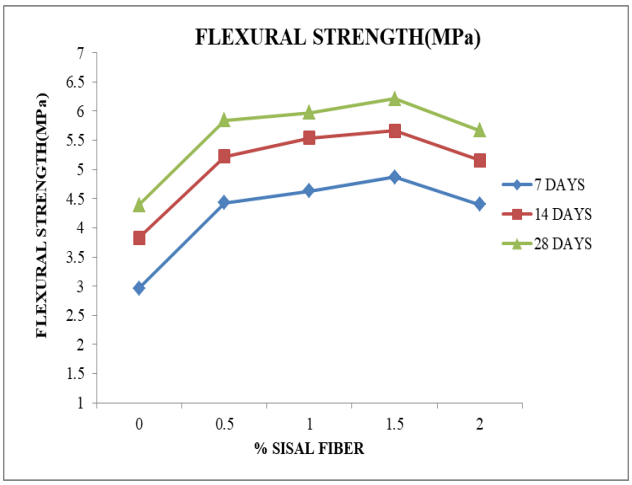

Fig 5.8 Effect Sisal fiber on flexural strength of concrete at 7 days, 14 days and 28 days curing

VII. CONCLUSIONS

- The purpose of this study was to investigate the use of Seashell Powder (SSP) and Sisal fibre (SF) in concrete as a waste material by assessing their effect in concrete specimens cured under normal water. The following conclusions are made based on the laboratory experiments carried out in this investigation.
- It has been observed that by the incorporation of Seashell Powder and Sisal fibre as partial replacement to cement in fresh and plain concrete decreases workability when compared to the workability with reference to concrete made without Seashell Powder (SSP) and Sisal fibre (SF).
- The significant improvements in strength characteristics were observed with Seashell Powder in concrete. It is evident from the present investigation that the Addition Seashell Powder to concrete improves compressive strength of the mix. Seashell powder concrete performed better when compared to ordinary concrete at 30% replacement will be the optimum seashell powder mix.
- The optimum strength was observed at 30% of seashell powder content for all type of strengths. The highest compressive strength obtained was 28.26 MPa (30% replacement) and on further additions of seashell powder caused reduction in strength due to an increase of free water content in the mix.
- Further addition of sisal fibre to the optimum content of seashell powder shows the significant improvements in strength characteristics. It is observed that highest compressive strength obtained was 31.2 MPa, split tensile strength obtained was 4.98 MPa and flexural strength obtained was 6.21 MPa at 1.5% addition of sisal fibre.
- The mix with sand replacement of 30% Seashell Powder and further addition of 1.5% Sisal fibre shows good strength properties like compressive and tensile and flexural strength.
- In this research it has been proposed the use of seashell powder and sisal fibre in concrete to increase the strength of concrete. Finally it can be summarized that the seashell powder and sisal fibre shown promising influence on the strength properties of concrete, thereby giving a two-fold advantage in improving the strength characteristics of concrete and also solving a problem of waste disposal.

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