An Experimental Investigation of Concrete by Partial Replacement of Silica fume, Ceramic tiles powder, Sea & Coconut shells

S.Mohanambal[1] , S.Nivetha[2], R.Saranya[3], R.Sountharya[4],

UG Students, Department of civil engineering, Selvam College Of Technology, Namakkal, Tamilnadu.

mohanamy12@gmail.com, sountharyar2016@gmail.com.

S.Karthikkumar

Assistant professor, Department of civil engineering, Selvam College Of Technology, Namakkal, Tamilnadu.

Karthiksana6@gmail.com

ABSTRACT:

An experimental investigation on silica fumes, powdered ceramic tiles and coconut and sea shells as partial replacement for cement, fine aggregate and coarse aggregate respectively in concrete work has been carried out. Experimental study has been conducted for approximately 10%, 12.5%, 15% & 17.5% of silica fume in partial replacement for cement.15%,20%, 30% & 35% of ceramic tiles powder in replacement for fine aggregate and 15%,20%,30% & 35% of coconut &sea shells in replacement for coarse aggregate separately. Experimental analysis done using compressive strength & flexural strength. Results were quite satisfactory with no compromise in strength requirements for M25 grade concrete. The experimental values optained are parameters such as weight of cement, aggregate, chemical admixture and water taken as inputs and results of tests are taken as target value and the network is trained to get the optimum mix.

INTRODUCTION

Concrete is a composite material consist of mainly water, aggregate, and cement. The physical properties desired for the finished material can be attained by adding additives and reinforcements to the concrete mixture. A solid mass that can be easily moulded into desired shape can be formed by mixing these ingredients in certain proportions. Silica fume, also known as micro silica is an amorphous (non-crystalline) polymorph of silicon dioxide. It is an ultrafine powder collected as a by-product of the silicon and ferrosilicon alloy production. It is extremely fine with particles size less than 1 micron and with an average diameter of about 0.1 microns, about 100 times smaller than average cement particles. Ceramic tiles waste were obtained from a local warehouse and powdered.. Its bulk density and water absorptions are 2.35 gm/cc and 0.45% respectively. Ceramic wastes are found to be suitable for usage as substitution for fine and coarse aggregates in concrete production. This study is an investigation into the utilization of waste replacement for fine tiles as partial fine aggregate. The freshly discarded shells (CS) were collected from the local oil mills and they were well seasoned. The seasoned CS is crushed by manually. The crushed edges were rough and spiky and the lengths were restricted to maximum of 12.5 mm. The surface texture of the shell was fairly smooth on concave and rough on convex faces.

Seashell is a waste obtained from Gummudipoondi at Sunambukulam which is near Pulicat lake, formed as the result of disintegration of dead animals Seashell consists of three layers outer, intermediate and inner layer. In this project coconut & sea shells were used for partial replacement of coarse aggregate.

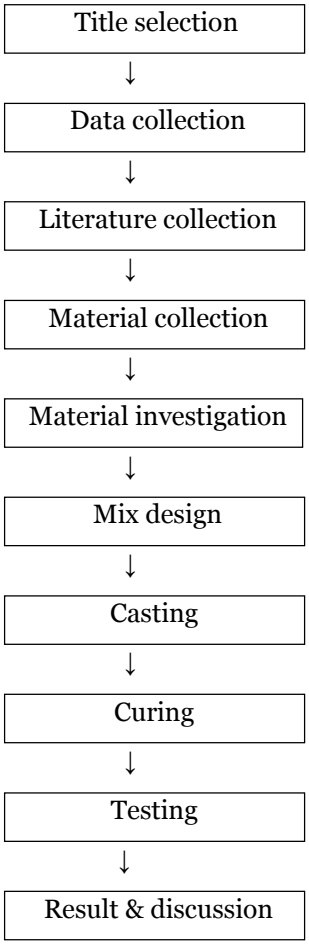
LITERATURE REVIEW

P.Chandrasekaran ,R. Ramesh Kumar,R. Praba Rajathi(2018) **–**this is the study of experimental analysis on concrete by partial replacement of fine aggregate with powdered ceramic tile. The test results for M30 grade concrete with water cement ratio of 0.4. For 40% replacement of sand with ceramic tile. The result leads to the effective utilization of ceramic tile waste thus by reducing the disposal and environmental problems. Using waste powdered ceramic tiles as partial replacement of fine aggregate, workability decreased with increase in replacement level. The optimal replacement level of fine aggregate with powdered ceramic waste was found to be 30%.The 40% replacement was a marginally less compressive strength with that of conventional concrete. The compressive strength increased up to 13.43% and the flexural strength increased up to 15.55% at 30% replacement level compared to conventional concrete. Powdered ceramic waste can be effectively used in concrete by reducing the environmental problem.

Lakhbir Singh, arjun Kumar , Anil Singh(2016)-This is the study of partial replacement of cement by silica fume. Silica fume were used to replace 0% to 15% of cement, by weight at increment of 5% for both cube and cylinder. The results showed that partial replacement of cement with silica fume had significant effect on the compressive strength of cube and split tensile strength cylinder. The strength of concrete increases rapidly as increases the silica fume content and the optimum value of compressive strength is obtained at 10% replacement. After 10% its start decreasing under uniform load condition of 4 KN and similarly the split tensile strength increases up to 10% and then start decreasing under the uniform load condition of 2KN.

Palak patel (2015)- The experiments were performed to replaced Coconut Shell as coarse aggregate in concrete of M 20 grade. The check the effect of size of CS in concrete. He used the various sizes of 8 mm,10mm and 12.5 mm in replaced 10% of CS.after 10% CS and added coir fibre in concrete on different tempreture.the following conclusions were obtain base on results. The addition of Cs increases as decrease the workability.The percentage of Cs increase as deceased compressive strength, split tensile strength and flexural strength as compared to conventional concrete. The replacement of CS up to 20% as to good result of compressive strength as compared to conventional concrete. The various sizes (8 mm, 10 mm and 12.5 mm) of 10% replace CS in concrete .the sizes of CS increase as decrease the split tensile strength, flexural strength and compressive strength. The result shows compressive strength of percentage replaced of Cs concrete in H_2SO_4 and Hcl solution curing are partially greater than the normal water curing.

METHODOLOGY



M25 CONCRETE MIX DESIGN AS PER IS:10262-1982

Target mean strength of concrete

$F_{ck} = F_{ck} + (t \times s) = 33.74\ N/mm^2$

Selection of Water cement ratio:

For 33.74 N/mm² W/C ratio is 0.45

Selection of Water and sand content:

Nominal Maximum size of aggregate 20 mm, Water content per cubic metre of concrete =186 kg, Sand content as % of total aggregate by absolute volume = 35%

Required water content = 186 + 186x3/100

= 186 + 5.58 = 191.61 /m³

Determination of cement content:

water cement ratio = 0.45

water =191.61

cement = 191.61/0.45 = 425.77 kg/m

Determination of coarse and fine aggregate content

$$V = \left[W + \frac{C}{S_c} + \frac{1}{p}\frac{f_a}{S_{fa}}\right] \times \frac{1}{1000}$$

$$V = \left[W + \frac{C}{S_c} + \frac{1}{1-p}\frac{C_a}{S_{ca}}\right] \times \frac{1}{1000}$$

F_a = 553.08 kg

C_a = 1200.07 kg

The mix proportion then becomes

Water: cement: fine aggregate: coarse aggregate

0.45 : 425.77 kg : 553.08 kg : 1200.07 kg

1 : 1.3 : 2.81

Take 1 : 1 : 2

TEST RESULTS

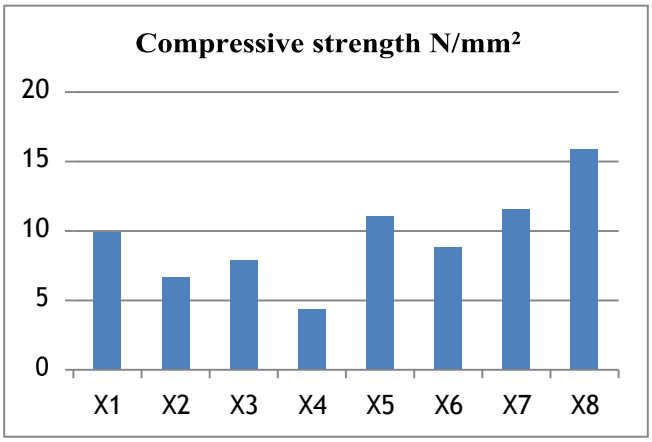
Compressive strength test:

The capability of concrete to resist the loads liable to lessen the dimension is termed as compressive strength test is made cube specimen of sizes 150mm x 150mm x 150mm for 28 days curing.

RESULT ANALYSIS

Fresh concrete is prepared For different proportions of replacement materials, after casting it into a mould the cube were kept at normal room temperature ,after one day demoulding was done, then cubes are immersed into the water for 7days , 14days , 28 days. Then the cubes were tested for its compressive strength by using CTM. Finally the test results were compared to conventional specimen.

S.no	Mix Designation	Percentage of Replacement Materials (SF+ CTP+ SCS)
1	X1	10+30+30
2	X2	12.5+32.5+32.5
3	X3	15+34+34
4	X4	17.5+35+35
5	X5	10+32.5+34
6	X6	12.5+34+35
7	X7	10+34+35
8	X8	10+15+15



CONCLUSION:

The study found that addition of silica fume, ceramic tiles powder, sea & coconut shells as partial replacement of cement, fine aggregate, coarse aggregate reduces the concrete workability due to its shape and rougher texture. However, it is motivating that the replacement of

Opc cement by silica fume at a level of 10%, fine aggregate by ceramic tiles powder at a level of 15%, natural coarse aggregate by sea& coconut shells at a level of 15% resulted of compressive strength is same as compressive strength of normal M25 concrete and also to the compared to control specimen. Integration of too much of sea& coconut shells produces harsher mix which causes disrupt the strength performance.

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