EXPERIMENTAL INVESTIGATION ON RCC ELEMENT USING GLASS POWDER AND PROSOPIS JULIFLORA ASH

Prof. K. Sharmiladevi[1], N. Nithish[2]

[1] Head of the Department, Department of Civil Engineering, Paavai Engineering College, Namakkal, Tamilnadu, India.

[2] Post Graduate Student, Department of Civil Engineering, Paavai Engineering College, Namakkal Tamilnadu, India.

ABSTRACT

Concrete is a building material that plays a significant role in the nation's infrastructure. Cement, fly ash, or another cementicious material is one of the essential components of conventional concrete. We must turn to alternative sources due to the problem of environmental global warming brought on by global effects and the high cost of cement quarries' production. Numerous studies have been conducted to replace aggregate, sand, and cement. The majority of admixtures are available in chemical composition on the market. However, the purpose of this project is to investigate the effects of replacing cement with Prosopis Juliflora wood ash (Seemaikaruvelam) by 10%, 20%, and 30%. Due to its reduced permeability, prosopis juliflora ash's fine structure improves its strength in later stages by filling more voids and providing superior pore structure. Concretes benefit from improved moisture resistance and durability as a result of micro-filling, which effectively reduces voids and pores in the material. The concrete specimens were tested at 7, 14, and 28 days using a grade M30 mix. Uses waste material effectively, is affordable, and performs as well as natural sand. When admixtures like sugar were added to the concrete mix, the experimental work mostly came to a conclusion following evaluation of workability and concentrates' compressive strength, split tensile strength, and acid attack test results. The mechanical properties of prosopis juliflora debris concrete were completed to decide the viability concrete solidified test for example compressive test, parting elastic test and flexural test.

INTRODUCTION

Concrete is a building material that plays a significant role in the nation's infrastructure. Cement, fly ash, or another cementicious material is one of the essential components of conventional concrete.

We must turn to alternative sources due to the problem of environmental global warming brought on by global effects and the high cost of cement quarries' production. Numerous studies have been conducted to replace aggregate, sand, and cement. The majority of admixtures can be purchased on the market as chemical compo sections. However, the purpose of this project is to investigate the effects of replacing cement with Prosopis Juliflora wood ash (Seemaikaruvelam) by 10%, 20%, and 30%. Due to its reduced permeability, prosopis juliflora ash's fine structure improves its strength in later stages by filling more voids and providing superior pore structure. The term "micro-filling" refers to the effect of reducing concrete pores and voids, improving moisture resistance and durability as a result. Ash is made up of numerous major and minor elements that a tree needs for growth. During the tree's growth cycle, the majority of these elements are extracted from the soil and atmosphere. These elements are common in our environment and have been essential to crop production for ages. The most abundant element in wood ash is calcium, which gives the ash properties similar to those of agricultural lime. Aluminium, potassium, phosphorus, magnesium, and ash are all excellent nutrients. The typical amount of wood ash in commercial fertilizer would probably be around 0- 1-3 (N-P-K). Wood ash is a good source of many micronutrients, including these macronutrients, which are necessary for adequate plant growth in trace amounts.

OBJECTIVE OF STUDY

1. To find the optimum usage of Prosopis Juliflora ash as a partial replacement of cement in concrete.
2. to check and compare the performance standard concrete and Prosopis Juliflora ash concrete.

MATERIALS AND ITS PROPERTIES

The materials used for this project are Portland pozzolona cement, Fine aggregate, Coarse aggregate, Prosopis Julifera Ash, Glass powder and Water

I. Cement

In this work, Portland Pozzolona Cement of Ultratech has been used. It was procured from a single source and stored as per IS: 4032 – 1977. Care has been taken to ensure that the cement of same company and same grade is used throughout the investigation. The cement thus procured was tested for physical properties in accordance with the IS: 1489-1991 (part 1), Tests on. The properties of the cement is tabulated in table 1.1

II. Fine aggregate

The aggregate which pass through 4.75 mm IS sieve and retain on 90micronmm IS sieve are known as fine aggregate. The fine aggregate used was locally available sand without any organic impurities and conforming to IS: 383 – 1970. Methods of physical tests for hydraulic cement. Sand is a naturally occurring granular material composed of finely divided rock and mineral particles is defined by size, being finer than gravel and coarser than silt. Sand can also refer to a textural class of soil or soil type; i.e., a soil containing more than 85 present sand-sized particles by mass. The properties of fine aggregate as observed from the laboratory tests are presented in Table 1.2

III. Coarse aggregate

The aggregate which pass through 75 mm IS sieve and retain on 4.75 mm IS sieve are known as coarse aggregate. The research work is restricted to sand collected from the river. The sand was collected to ensure that there was no allowance for deleterious materials contained in the sand and the size of 5 mm. In this research, granite of 20 mm maximum size was used. The properties of coarse aggregate as observed from the laboratory tests are presented in Table 1.3

IV. Prosopis Julifera Ash

Three different proportions of concrete mix (NA replacement of 5%, 10%, 15%, 20%) by weight of cement) including the control mixture were prepared with water to binder ratio of 0.45. The specific gravity of NA was found to be less than that of cement. Specific gravity of Juliflora ash is 2.71 conforming to BS 5628-1: 2005. The suitable range of specific gravity of juliflora ash is 1.6 to 2.8.The properties of the PJA is tabulated in table 1.4

V. Glass powder

The present study shows that waste glass, if ground finer than 600Âµm shows a pozzolanic behaviour. It reacts with lime at early stage of hydration forming extra CSH gel thereby forming denser cement matrix. Thus, early consumption of alkalis by glass particles helps in the reduction of alkali- silica reaction hence enhancing the durability of concrete. Number of tests was conducted to study the effect of 0%, 10%, 20%, 30% and 40% replacement of cement by glass powder on workability and compressive strength. The properties of Glass powder as observed from the laboratory tests are presented in Table 1.3

Table1.1: Properties of cement.

Sl.no	Physical properties	Values
1.	Specific gravity	3.15
2.	Water absorption	1.63%
3.	Admixture	ECHMAS 890

Table 1.2: Properties of Fine Aggregate.

Sl. No	Physical properties	Values
1.	Specific gravity	2.65
2.	Water absorption	2.5%
3.	Surface moisture	NIL
4.	Grading Zone	ZONE II

Table 1.3: Properties of Coarse Aggregate.

Sl. No	Physical properties	Values
1.	Specific gravity	2.65
2.	Water absorption	2.5%
3.	Surface moisture	NIL
4.	Grading Zone	ZONE II

MIXTURE PROPORTION AND TEST PREPARATION

a. Mix design proportion

The mix design as per IS 10262:2009 is in line with ACI 211.1The code permits the use of supplementary materials such as chemical and mineral admixtures. Provisions of IS 456:2000 are applicable for durability requirements with all types of expo sure. Concrete mix designs adopted throughout this study were undertaken in accordance with the procedure specified in IS (Indian Standards). All mixes were proportioned in order to achieve a design compressive strength of 35 MPa after 28 days. A control mix was produced containing only natural aggregate, with five resulting mixes incorporating waste glass as a partial replacement for fine aggregates in proportions of 15, 20, 25, 30 and 40%. As the crushed glass exhibited a lower fineness modulus than the natural aggregate, minor adjustments were made to each mix design to ensure that strength and workability design parameters remained constant.

d. Compression test

Compressive strength of concrete cube test provides an idea about all the characteristics of concrete. Cube Test Result Samples with 5%, 10%, 15% and 20% 25% and 30% replacement of cement with PA ash were casted. The cubes were casted as per the procedure specified in IS: 10262 (1982), IS 516:1959 and IS 456:2000. The strength of 3 samples was tested at 3, 7, 14 and 28 days using compression testing machine. The compressive strength values were compared with that of conventional concrete mix of M30. The obtained results are shown in graph.

e. Split tensile strength

The tensile strength of concrete is one of the basic and important properties which greatly affect the extent and size of cracking in structures. Moreover, the concrete is very weak in tension due to its brittle nature. Hence. It is not expected to resist the direct tension. So, concrete develops cracks when tensile forces exceed its tensile strength. Therefore, it is necessary to determine the tensile strength of concrete to determine the load at which the concrete members may crack. Furthermore, splitting tensile strength test on concrete cylinder is a method to determine the tensile strength of concrete. The procedure based on the ASTM C496 (Standard Test Method of Cylindrical Concrete Specimen) which similar to other codes IS 5816 1999.

d. Flexural strength test

Flexure tests are generally used to determine the flexural modulus or flexural strength of a material. A flexure test is more afford able than a tensile test and test results are slightly different. The material is laid horizontally over two points of contact (lower support span) and then a force is applied to the top of the material through either one or two points of contact (upper loading span) until the sample fails. Flexural strength is defined as the maximum stress at the outermost fibre on either the compression or tension side of the specimen. Flexural modulus is calculated from the slope of the stress vs. Strain deflection curve. \These two values can be used to evaluate the sample materials ability to withstand flexure or bending forces.

TEST RESULTS

a. Compressive Strength of Concrete:

The test results of Grade M20 are tabulated below in 1.5

JPA %	7 Days	14 Days	28 Days
0	15.12	18.3	21.2
0.25%	16.9	22.4	24.93
0.5%	12.5	16.4	19.3
0.75%	12.4	15.1	18.8

b. Compressive Strength of Concrete:

The test results of Grade M50 are tabulated below in 1.6

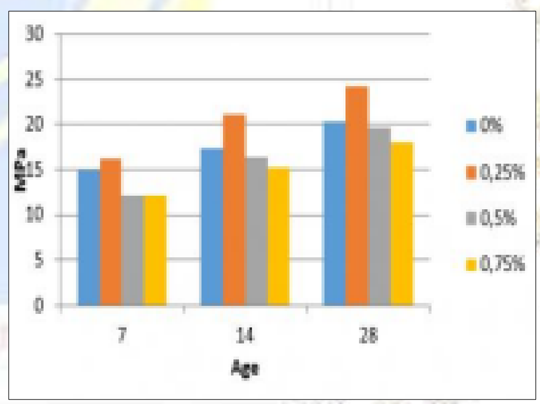
JPA %	7 Days	14 Days	28 Days
0	500	684	691
0.25%	530	703	746
0.5%	590	734	778
0.75%	550	961	644

c. Flexural Strength of Concrete:

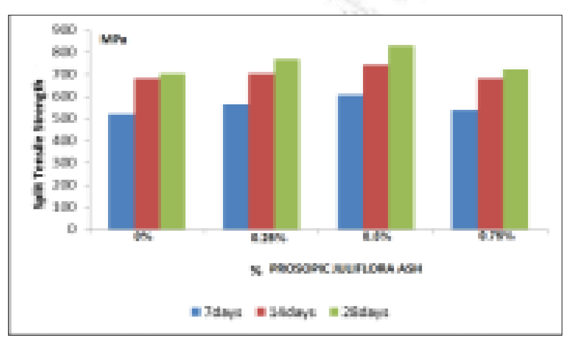
The 25% replacement of PJA and WGP as maximum strength attained. Flexural strength is defined as the maximum stress at the outermost fibre on either the compression or tension side of the specimen. Flexural modulus is calculated from the slope of the stress vs. strain deflection curve. These two values can be used to evaluate the sample materials ability to withstand flexure or bending forces. It is explained that the 25% replacement of PJA and WGP as maximum strength attained

COMPARISON OF SPECIMENS

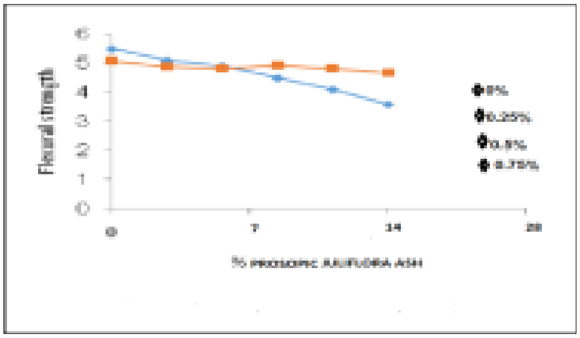
The effect of using Glass powder and Prosopis Julifera powder has an enormous difference in the compressive strength, Split tensile strength and Flexural strength test



Compressive Strength vs. % Mix PJA



Split Tensile Strength vs. % Mix PJA



Flexural Strength vs. % Mix PJA

DISCUSSION

The 28-day compressive strength of cube with all the three percentages of replacement satisfied the strength requirement. The 3,7,14 and 28- day compressive strength of cube with 25% replacement of cement with Juliflora ash was founded as Optimum value.

Objectives are concluded with the values. The utility of Prosopis Juliflora ash as a partial replacement of cement in concrete in correct way as per IS Codal Provisions up to 25% at maximum. Compare the performance with standard concrete and Prosopis Juliflora ash concrete in the Results can be acceptable t IS codes. It is also act as SELF RETARDER parameter to increase the Set ting time as well as increased. Material Properties of Materials and PJA can be completed. To found out the mechanical and durability of concrete.

CONCLUSION

In the series of tests without any chemical material, the slump was measured for each rate of glass powder. The recorded value of each case; Figure 3b gives the present value of the slump relative to that of the control mixture for 350 and 400 kg cement. The results mark clearly a considerable decrease of consistency where increasing the glass powder in the mixture results in a significant decrease of concrete workability; this loss of consistency depends on the rate of glass powder and conversely with the cement content where the loss of slump, in the case of 15% of glass powder, reaches 35% for 350 kg cement and 22% for 400 kg cement. The decrease of workability could be interpreted due to the high surface tension of glass powder, justified by the strong capillary action. While the quantity of cement plays a reverse role, due to the amount of paste in the batches, which increases the constancy of concrete by its gelatinous property. Looking at the results of the simple compression test, for the cases of 350 and 400 kg cement, there was a decrease of strength for the age of 3 days relatively to the control mixtures. However, there was slight increase of strength for the ages of 28, 56 and 90 days.

REFERENCES

[1] Jay Sanjayan, Jeeva S. Ali, Jatin Arora and Karamjit Sing ‘‘Mechanical Properties Evaluation of Functionally Layered Cement Composites Ali Bagheri1” at 2020.

[2] P. jagadeesan, N. Sudharsan, S.M. Subash, Pardeep Thirumoorthy, B.Sugumaran, Jabar Abdul Bari, R. Vetturayasudharsanan, D. Ambika, K. Sharmiladevi and Kathiresan karuppan, Study on performance of in filled wall in an RC-Framed Structure Using a Reinforced band.

[3] Chegenizadeh, A., Nikraz, H. (2011a). ‘‘Investigation on strength of fibre reinforced clay” Advanced Materials Research 261-263, pp. 957-963. 2020 Jan

[4] R. Dharmaraj, R. Malathy, Study on strength and behaviour of self-compacting concrete.