Experimental Study on Partially Replacing Concrete By Using Prosopis Juliflora Ash And Foundry Sand

Ashmi A
Master of Structural Engineering,
Ponjesly College of Engineering

Abstract- *In recent years, the main importance is on green and sustainable development throughout the world. Cement industries are releasing the numerous gases, which is one of the main reasons in environmental pollution. Also, Prosopis Juliflora plant now becomes a threat to the environmental system. Since it grows up to 50 ft deep and also it absorbs more ground water. So, using Prosopis Juliflora Ash (PJA) as partial replacement for cement is a dual purpose as meeting the demands of construction industry and at the same time providing a sustainable development. Generally, PJA does not have cementitious property by itself which is responsible for strength generation. But in presence of water it reacts with free lime obtained from cement and form hydrated products such as C2S and C3S which helps in attaining the strength and also improving the durability. Several developing countries have encountered some strain in the supply of natural sand in order to meet the increasing need of the infrastructural development in recent year, to overcome the stress and demand of river sand, researchers and practitioners in the construction industry have identified some alternative. One of them is foundry sand, it is a high quality silica sand with uniform physical characteristics and by product of ferrous and non-ferrous metal casting industry. In this project we are verifying the above thoughts, by using PJA as replacement to cement at 25 to 40% with every increment of 5%. Here, I have to find out the mechanical properties (Compressive, Split tensile) and durability properties (Acid attack and Alkaline attack) of concrete at different curing periods and were compared with control mix of M20 grade*

Keywords- ash, aggregate, concrete, sustainable

I. INTRODUCTION

In today's world the main emphasis is on green and sustainable development. Cement industry is one of the major contributors to pollution by releasing carbon dioxide. So by partially replacing cement with pozzolanic material such as prosopis juliflora ash, the cement industry can serve both the purpose of meeting the demands of construction industry and at the same time providing a green and clean environment While on the other side the industries has developed on large quantity. Metal industry is one of them. Metal industry has many waste product, and at a certain period this wastes are not used further. This waste generated is the main environmental problem. One of the waste generated from metal industries which can be helpful to overcome the demand fine sand is foundry sand, using this is a major step towards sustainable development. Prosopis juliflora ash does not have cementitious property by itself which is responsible for strength generation. But in presence of water it reacts with free lime obtained from cement and form hydrated products (C2S and C3S) which helps in attaining the strength and also improving the durability. As the prosopis juliflora ash is very fine in structure, it fills the voids and provides superior pore structure and there by improves its strength at later stages due to reduced permeability.Prosopis juliflora is a type of tree which absorbs ground water and atmospheric moisture heavily. Recently the Tamilnadu government started removing the tree with the help of PWD. Hence the Juliflora has been mostly used in industries, power plants, incineration, etc. hence the residue generation is more. The industrial byproducts (waste) are being accumulated to a large extend leading to environmental and economic concerns related to their disposal. Cement emits vast amount of greenhouse gases, forcing researchers to look for an alternative such as sustainable building practice. Prosopis Juliflora ash as a partial replacement of cement in concrete. The characteristics of the ash depend upon 3 biomass characteristics (herbaceous material, wood or bank), combustion technology (fixed bed or fluidized bed) and the location where ash is collected. As wood ash primarily consists of fine particular matter which can easily get air borne by winds, it is a potential hazard as it may cause respiratory health problems to the dwellers near the dump site or can cause groundwater contamination by leaching toxic elements in water. As the disposal cost of the ashes is rising and volume of ash is increasing, a sustainable ash management which integrates the ash within the natural cycles needs to be employed. Juliflora ash is also a similar waste materials produced from Juliflora burning industries which is mainly used as a fertilizer for soil. Significant quantities of Juliflora ash is currently land filled near the industries that uses Juliflora as a fuel partially or fully which poses a threat to the environment in many ways to life stock around. Chemical analysis of Juliflora ash shows that it has pozzolanic property, and using it as a partial replacement to

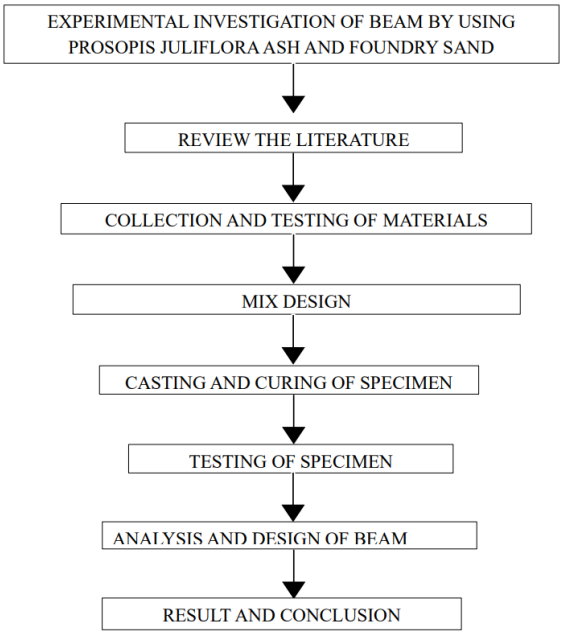
cement may be done of the best application in the current environment scenario. Prosopis Juliflora grows tremendously and spreads due to its mechanism to overcome adverse conditions of like drought and salt. This is facilitated by its high 'proline' content under stress conditions, which helps the plant to thrive where other species die. Prosopis Juliflora ash is difficult to decompose. So using this is a major step towards sustainable development. Also the concrete Is weak in tension, so with the addition of steel fibers it's flexural and tensile strength is also enhanced. Prosopis Juliflora ash does not have cementitious property by itself which is responsible for strength generation.

Objectives

- To study the mechanical properties of M20 Grade concrete by Prosopis Juliflora Ash.
- To utilize the unnecessarily grown Prosopis Juliflora Ash in a useful way to increase the strength of concrete.
- To analyze the different areas of civil engineering in whichfoundry sand can be efficiently used.
- To prevent the depletion of ground water source.
- To minimize environmental and ecological problems.
- To reduce the cost of construction.

II. METHODOLOGY

Methodology involves studying the methods used in the project and the theories or principles behind them, in order to develop an approach that matches the objectives.



A. COLLECTION OF MATERIAL

The materials are locally available stone aggregate, m sand, ordinaryportland cement were used for normal concrete and also super plasticizer were used.

Material properties and characteristics are explained below.

- Cement
- Fine Aggregate
- Coarse Aggregate
- Water
- Prosopis Juliflora Ash
- Foundry sand

B. TESTING OF MATERIALS

Sl.No	Material	Name of the material test	Obtained value	Permissible value
1	Cement	Specific gravity of cement	3.15	3.1 to 3.5
		Initial setting time test	30 minutes	Not less than 30 minutes
		Final setting time test	10 hours	
		Fineness test on cement	4.33%	Not less than 10%
2	Fine Aggregate	Specific gravity of FA	2.61	2.4 to 2.9
		Water absorption	0.99%	0.1 to 2%
3	Coarse Aggregate	Specific gravity of CA	2.73	2.4 to 2.9
		Aggregate impact test	10.35%	Not more than 20%
		Water absorption	1%	0.1 to 2%
4	Prosopis Juliflora Ash	Fineness test	1.33%	Not more than 10%
		Specific Gravity	2.1	2 to 2.7

III.EXPERIMENTAL INVESTIGATION

Batching :

For good quality concrete a proper and accurate quantity of all the ingredients should be used. So, the aggregates, cement and water should be measured accurately. There are two methods of batching and weighing the batching.

1) Volume batching : Volume batching is generally recommended for small jobs only, the amount of each solid ingredient is measured by loose volume using standard box known as gauge box.
2) Weigh batching :For all important works weigh batching is generally used. The weighing is done by ordinary platform

weighing machine. The method which we have adopted is weigh batching. The weight of materials taken for cube and cylinder mold will differ.

Mixing : Mixing of concrete is simply defined as the complete blending of the material which is required for the production of a homogenous concrete. Mixing is need to be done to bind all the materials and to avoid the voids preset between them. All the aggregate particles should have a coat of cement paste and all the ingredients of the concrete should blend into a uniform mass. The mixing is done either by hand or by machine.

Placing: After the mold is prepared, the mixed concrete materials ready for placing is poured gently into the molds. The concrete is filled up to the level of the mold. 19 Fox each mix, three specimens are to be prepared to know the exact strength of the concrete the mold. Fox each mix, three specimens are to be prepared to know the exact strength of the concrete.

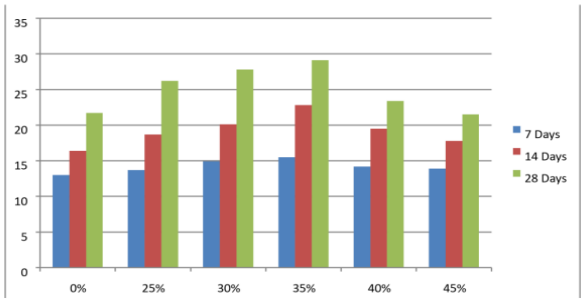
Finishing: After the mold has been filled, the extra concrete found should be struck off using the trowel. It must be made sure that the surface is smooth.

Curing: Curing is a process to maintain an adequate moisture content and temperature in concrete at early ages so that it can develop properties the mixture was designed to achieve. Curing begins immediately after placement of concrete and finishing so that the concrete may develop the desired strength and durability

IV. RESULTS AND DISCUSSION

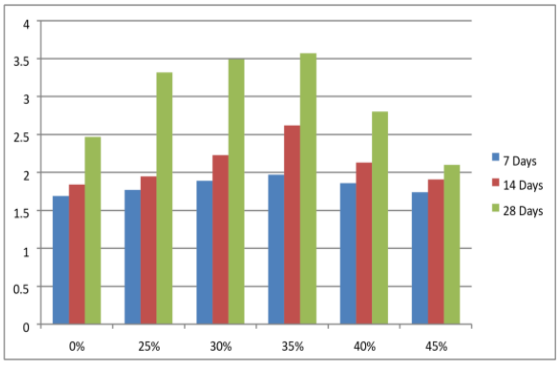
Compressive Strength Test

% of Prosopis Juliflora Ash		Compressive Strength (N/mm.sq)	
	7 Days	14 Days	28 Days
0%	13	16.4	21.7
25%	13.7	18.7	26.2
30%	14.9	20.1	27.8
35%	15.5	22.8	29.1
40%	14.2	19.5	23.4
45%	13.9	17.8	21.5



Split Tensile Strength Test

% of Prosopis Juliflora Ash		Tensile Strength (N/mm.Sq)	
	7 Days	14 Days	28 Days
0%	1.69	1.84	2.47
25%	1.77	1.95	3.32
30%	1.89	2.23	3.49
35%	1.97	2.62	3.57
40%	1.86	2.13	2.8
45%	1.74	1.91	2.1



V. CONCLUSION

Based on the result and discussions the following conclusions were drawn. When PJA is added in concrete as partial replacement of cement, the emission of CO2 is reduced when compared with conventional concrete. The incorporation of Prosopis Juliflora Ash (PJA) and foundry sand (FS) in concrete demonstrates significant potential as a sustainable and cost-effective alternative to conventional cement and fine aggregate. The partial replacement of cement with PJA enhances the pozzolanic reaction, contributing to improved long-term strength and durability, while the use of FS as a fine

aggregate replacement reduces the demand for natural river sand and promotes industrial waste utilization. Moreover, this approach contributes to environmental sustainability by reducing carbon emissions, minimizing waste disposal issues, and conserving natural resources. The use of PJA and FS in concrete not only offers technical and economic advantages but also aligns with green construction practices. The compressive strength and split tensile strength showed that the strength properties of concrete increased with increase in PJA contents up to 35%. Aim of this project is to reduce the CO2 emission and the growth of Prosopis Juliflora which a threat to our environment. The successful result shows the aim was achieved. The strength properties of concrete increased with increase in PJA contents up to 35%, after that the strength was decreased as compared to conventional concrete. In PJA concrete the durability increases with increase in replacement level. PJA at replacement percentage up to 35% of the weight of binder can be successfully used as additive in place of cement to produce the structure grade concrete. At the same time, PJA at replacement percentage up to 30% of the weight of binder can be successfully used as additive in place of cement to produce the good durability of concrete.

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