COMPRESSIVE STRENGTH OF CONCRETE WHEN TAMARIND KERNEL POWDER IS USED AS AN ADDITIVE

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Abstract - *Concrete is one of the most widely used building materials. Thus research on its properties enhancement is foremost criteria for modern civil engineers. From years engineers are trying to enhance its properties either with the help of additives termed as admixtures or with the partial replacement of cement compound with test material. In this project our aim is to check the impact of TAMARIND KERNEL POWDER (TKP) over the properties of cement when used as additives. Dilution factor for the solution is determined by observation analysis. Compressive strength of the cement is identified with the help of split tensile test. Workability is being measured with the help of slump cone test.*

Key Words*: *Concrete, Admixtures, Dilution Factor, Compressive Strength, Workability

1. INTRODUCTION

Admixtures are added in fresh concrete so as to enhance specific desired property. Various properties which are being influenced by admixtures are Strength, Durability, Workability, Serviceability etc. Admixtures are readily used by developed countries regardless of the method of production of Concrete that is whether being manufactured in situ or ex situ. Certain various types of Admixtures that are being readily used by this countries are Air Entraining Admixture, Super plasticizers, Plasticizers, Accelerators, water retarders etc. Chemical admixtures are costlier such that it can be preferred only for construction of special buildings. Thus advantage of these admixtures cannot be taken by common man, more over preparation method for certain chemical admixtures are harmful to the environment. Thus our intention is to have a cheap natural admixture rather than artificially prepared chemical admixtures which are costlier.

1.1 Tamarind Kernel Powder

Tamarind is one of the highly cultivated trees in India. In fact India is one of the highest cultivator of Tamarind in the world. Tamarind is locally referred as *'imli'*. The major areas of production are in Asian countries like India, Bangladesh, Sri Lanka, Thailand, Indonesia, and in the African and the American continents. Tamarind trees are more abundantly available in Tamil Nadu. Tamarind consists of 3 parts – tamarind fruit pulp which is edible, hard green fruit pulp, and tamarind seed. Tamarind seed powder generally known as Tamarind Kernel Powder (TKP) is already being used for manufacturing tamarind oil, tamarind gum, and tamarind starch. TKP is obtained by removing testa (tough shell) from seed and obtaining the kernel which is rich in starch.

2. TERMINOLOGIES

CONCRETE - Concrete is a heterogeneous mixture composed of Cement, Fine Aggregate and Coarse Aggregate mixed in the required proportion.

ADMIXTURES – Additional material used for improving the properties of concrete.

DILUTION FACTOR – The solution used as an additives is prepared by using proper dilution ratio so as to achieve less mixing time when used in the field. It is the ratio of the amount of *Tamarind Kernel Powder (in gms)* used and the amount of water (in ml) used.

COMPRESSIVE STRENGTH – The load bearing capacity of the member when used as an compressive member. This is obtained by using SPLIT TENSILE STRENGTH.

WORKABILITY – The ease with which concrete can be placed or can be worked with it is termed as workability of concrete.

3. METHODOLOGY

3.1 Dilution Factor

Observational Method is used for identifying the dilution factor. Importance was given to the fact that when solution will be used in future it must not take more time in mixing with water and which mixes with water used for construction with ease. The Dilution factor what we have adopted for our Project is that we mixed ***5gm of TKP powder with 150ml*** of distill water and then heat it at the suitable temperature to attain desired viscosity.

3.2 Concrete Mix Design (M30 Grade)

A-1	**Stipulations for Proportioning**	
1	Grade Designation	**M30**
2	Type of Cement (confirming to IS-12269-1987)	PPC 43 Grade
3	Maximum Nominal Aggregate Size	20 mm
4	Minimum Cement Content (MORT&H 1700-3A)	310 kg/m3
5	Maximum Water Cement Ratio (MORT&H 1700-3A)	0.45
6	Workability (MORT&H 1700-4)	50 mm (Slump)
7	Exposure Condition	Normal
8	Degree of Supervision	Good
9	Type of Aggregate	Crushed, Angular
A-2	**Test Data for Materials**	
1	Cement Used	PPC 43 Grade
2	Sp. Gravity of Cement	3.223
3	Sp. Gravity of Water	1
4	Sp. Gravity of Coarse Aggregate	2.82
5	Sp. Gravity of Sand	2.64
6	Water Absorption of Coarse Aggregate	0.97%
7	Water Absorption of Sand	1.23%
8	Specific Gravity of TKP	1.33
9	Free (Surface) Moisture of Coarse Aggregates	Less than 1 %
10	Free (Surface) Moisture of Sand	Less than 1 %
11	Sieve Analysis of Individual Coarse Aggregates	Separate Analysis Done
12	Sieve Analysis of Combined Coarse Aggregates	Separate Analysis Done
13	Sp. Gravity of Combined Coarse Aggregates	2.84
14	Sieve Analysis of Fine Aggregates	Separate Analysis Done
A-3	**Target Strength for Mix Proportioning**	
1	Target Mean Strength (IS10262-2009)	38.25 N/mm^2
2	Characteristic Strength @ 28 days	30 N/mm^2

A-4	Selection of Water Cement Ratio	
1	Maximum Water Cement Ratio (MORT&H 1700-3A)	0.45
2	Adopted Water Cement Ratio	0.45
A-5	**Selection of Water Content**	
1	Maximum Water content (10262-table-2)	186 Lit
A-6	**Calculation of Cement Content**	
1	Water Cement Ratio	0.45
2	Cement Content (186/0.45)	414 kg/m^3
A-7	**Proportion of Volume of Coarse Aggregate & Fine Aggregate Content**	
1	Vol. of C.A. as per table 3 of IS: 10262	62.00%
2	Corrected Vol. of Coarse Aggregate for 0.45 W/C ratio (increased by 0.01 for every 0.05 decrease in W/C ratio)	61.00%
3	Adopted Vol. of Coarse Aggregate (10% reduction for angular aggregates)	55% - 0.55
4	Adopted Vol. of Fine Aggregate	45% - 0.45

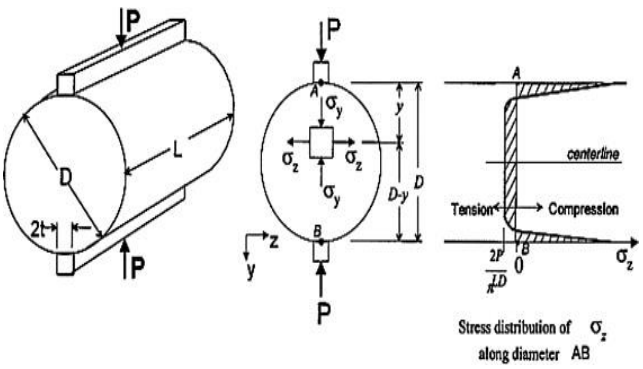
Volume of Cylinder = $\pi R^2 h = \pi * 0.075^2 * 0.3 = 0.005301\ m^3$

Volume of 3 cylinder (wet concrete) = 0 .0159 m^3

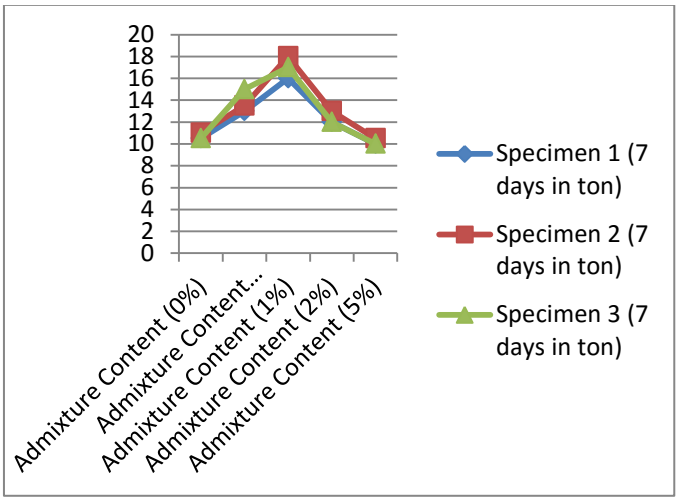
Volume of dry concrete = 1.5*0.0159 = 0.02385 m^3

Percentage of Admixture / Materials required for 3 Cylinder specimen	0	0.5	1	2	5
Mass of Cement	9.87 kg	9.821 kg	9.772 kg	9.673 kg	9.376 kg
Mass of Fine Aggregate	19.43 kg	19.379 kg	19.335 kg	19.246 kg	18.984 kg
Mass of Coarse Aggregate	25.534 kg	25.479 kg	25.421 kg	25.304 kg	24.96 kg
Mass of Admixture	0 kg	49 gm	98 gm	197 gm	494 gm
Mass of Water (0.45 w/c ratio)	4.44 kg	4.42 kg	4.4 kg	4.35 kg	4.22 kg

3.3 Test Conducted & Result



Compressive Strength of Concrete is obtained by testing 3 specimen each for 7 days with varying admixture content



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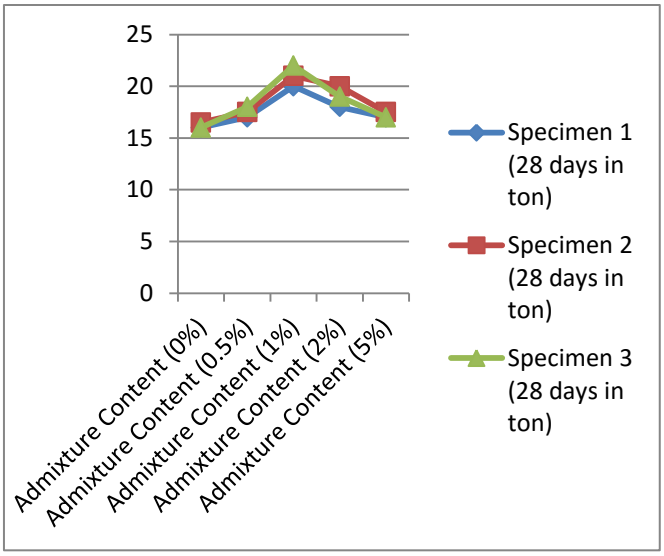

4. CONCLUSION

The above data shows that there is significant improvement in concrete strength when TKP is used as an admixture. This helps in designing slender beams or column with the same load bearing capacity. Thus reduces the overall dead load of structure which is one of the biggest concerns of structural engineer.

5. PRECAUTION

Avoid use of excessive vibration as this causes segregation and bleeding though the water retention property of concrete is improved when the TKP solution is used. As TKP solution is polysaccharide solution it is suggested to remove the mould after 2 days to achieve proper strength.

6. FUTURE SCOPE

More work needs to be carried out with varying dilution factor. Testing is to be done in different zones and with different grades so as to accept this universally. The additive gives very stiff paste. Thus water cement ratio also need alteration for using this with concrete in field as we all desire workable concrete.

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